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Report 2230

FORKLIFT TRUCKS, GASOLINE-ENGINE-DRIVEN, 4000- TO 6000-POUND-CAPACITY – USER SURVEY

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and
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February 1978

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20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

This report is the result of recent emphasis on procuring commercial items in lieu of Military Adaptation of Commercial Items (MACI). Four major forklift truck manufacturers were surveyed, and their candidate models for the three size requirements were obtained. Commercial users of these forklift trucks were then visited by a Survey Team using a User Survey Questionnaire designed to obtain the data required. This report presents the methodology, results, and conclusions of evaluating the established commercial market acceptability of these commercial forklift trucks.

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The compiled results are discussed and commercial forklift trucks are compared for variance with the requirements of the existing MACI specification for forklift trucks.

The Survey results support the general conclusions: The Reliability, Availability, and Maintainability (RAM) characteristics of the commercial forklift trucks surveyed are acceptable to their commercial users.

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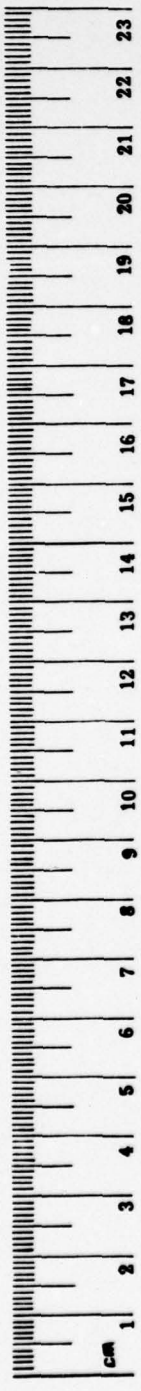
METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

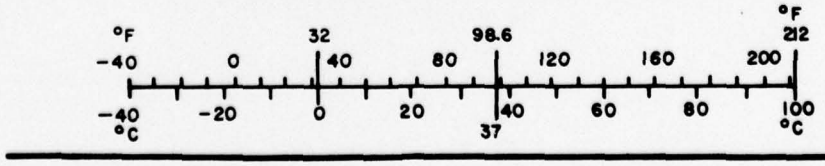
Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	metric tons	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	L
pt	pints	0.47	liters	L
qt	quarts	0.95	liters	L
gal	gallons	3.8	liters	L
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

* 1 in = 2.54 cm (exactly).



Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
	LENGTH			
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
	AREA			
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10 000 m^2)	2.5	acres	
	MASS (weight)			
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	metric tons (1000 kg)	1.1	short tons	
	VOLUME			
ml	milliliters	0.03	fluid ounces	fl oz
L	liters	2.1	pints	pt
L	liters	1.06	quarts	qt
L	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
	TEMPERATURE (exact)			
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



FORKLIFT TRUCKS, GASOLINE-ENGINE-DRIVEN, 4000- to 6000-POUND CAPACITY – USER SURVEY

I. INTRODUCTION

1. **Background.** On 24 May 1976, the Office of Management and Budget directed the Government to emphasize the acquisition of commercial, off-the-shelf products in order to achieve optimal effectiveness in supply support operations. The resulting emphasis on procurement of commercial products included forklift trucks used by the Army. Therefore, a program was undertaken by MERADCOM to develop a procurement document whereby commercial, off-the-shelf, forklift trucks can be procured and supported. The major elements in this program are as follows:

a. Prepare the Manufacturer Survey Questionnaire.
b. Conduct and report the Manufacturer Survey.
c. Prepare the User's Survey Questionnaire.
d. Conduct and report the User Survey.
e. Develop the procurement specification.
f. Procure commercial forklift trucks.
g. Type classify.

The first two program elements have been completed and are reported separately.*

2. **Description of Material.** Table 1 summarizes the forklift truck described by each manufacturer in the Technical Information Packages submitted to MERADCOM.

Table 1. Forklift Trucks Listed by the Four Manufacturers Surveyed

Manufacturer	Model No.		
	4000-lb Solid-Rubber Tire (SRT) (144-in. lift height) Size 1	4000-lb Solid-Rubber Tire (SRT) (180-in. lift height) Size 2	6000-lb Pneumatic Tire (PT) (180-in. lift height) Size 3
Allis-Chalmers	ACC45B	ACC45B	ACP70
Clark	C300-40	C300-40	C500-Y70
Hyster	S50C	S50C	H70C
Towmotor	T40B	T50B	V60B

* J. E. Stephens, Jr. and J. W. Reid, Jr.; "Forklift Gasoline-Engine-Driven, 4000- to 6000-Pound-Capacity – Manufacturers Survey." MERADCOM Report 2231; November 1977.

These forklift trucks are shown in Figures 1 through 9. The four manufacturers described their forklift trucks as "commercial, off-the-shelf, forklift trucks" which would satisfy the Army's requirement for three different sizes of forklift trucks. The following general requirements for these three sizes were provided each manufacturer and correlate to the listings in Table 1.

	Size 1	Size 2	Size 3
Lift Capacity (lb):	4000	4000	6000
Lift Height (in.):	144	180	180
Load Center (in.):	24	24	24
Engine (type):	Gasoline	Gasoline	Gasoline
Tire (type):	Solid-Rubber	Solid-Rubber	Pneumatic
Transmission:	Automatic	Automatic	Automatic
Manueverability (right-angle-turn dimension (in.) 48-in. by 48-in. pallet):			
Without Sideshifter (in.):	150	156	196
With Sideshifter (in.)	154	160	200
Ambient Temperature Range:	0° – 110°F	0° – 110°F	0° – 110°F
Typical Use:	In general warehouses, depots, and other defense installations.		

Finally, an important conclusion contained in the manufacture survey report is: Forklift trucks used by Industry do not differ significantly from forklift trucks previously procured by the Army using Military Specification MIL-T-52862. A forklift truck procured using this specification is shown in Figure 10. This specification was also assumed to represent the requirement for commercial forklift trucks in lieu of a formal requirement such as a Required Operational Capability (ROC).

3. **Objective.** The objective of this survey is:

a. To assess the Reliability, Availability, and Maintainability (RAM) characteristics of the four forklift trucks using data solicited from industrial users.

b. To determine the procedure used by Industry to procure commercial forklift trucks.

c. To determine Industry's management philosophy for the forklift truck's life cycle.

4. **Scope.** This report considers the third and fourth elements of the MERADCOM program designed to support procurement of commercial, off-the-shelf, forklift trucks. These elements are:

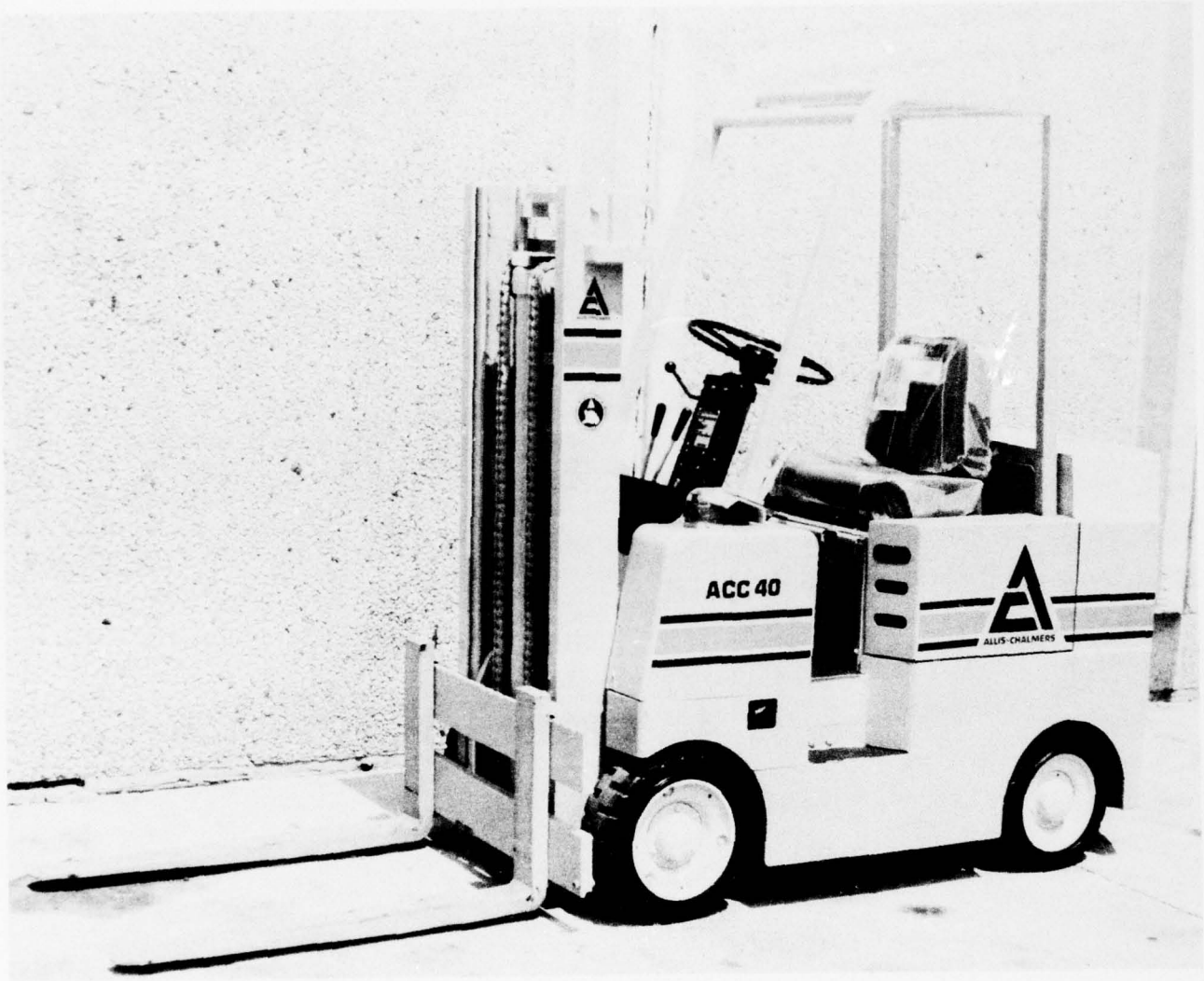


Figure 1. Allis-Chalmers forklift truck similar to Model ACC45B.

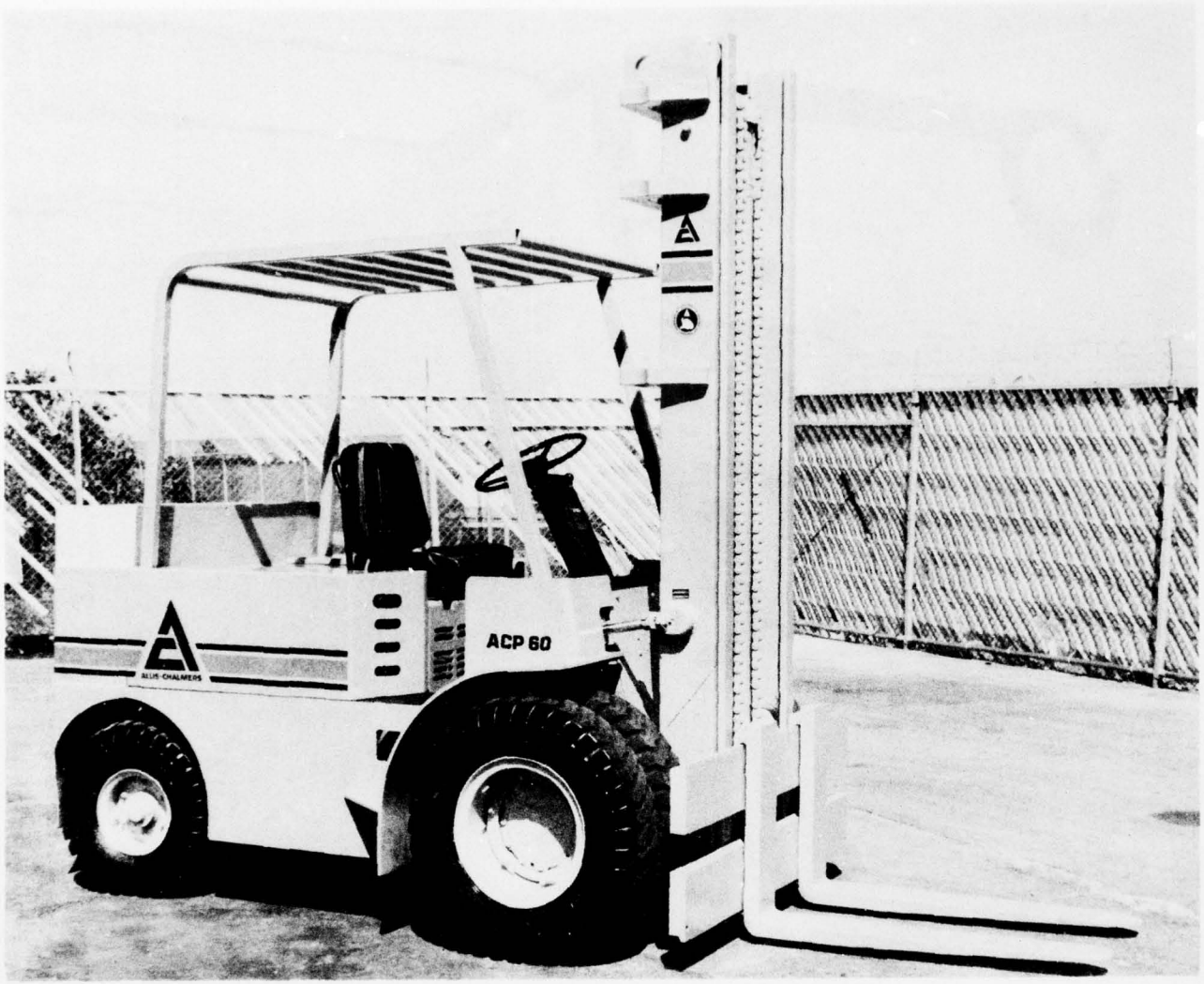


Figure 2. Allis-Chalmers forklift truck similar to Model ACP 70.

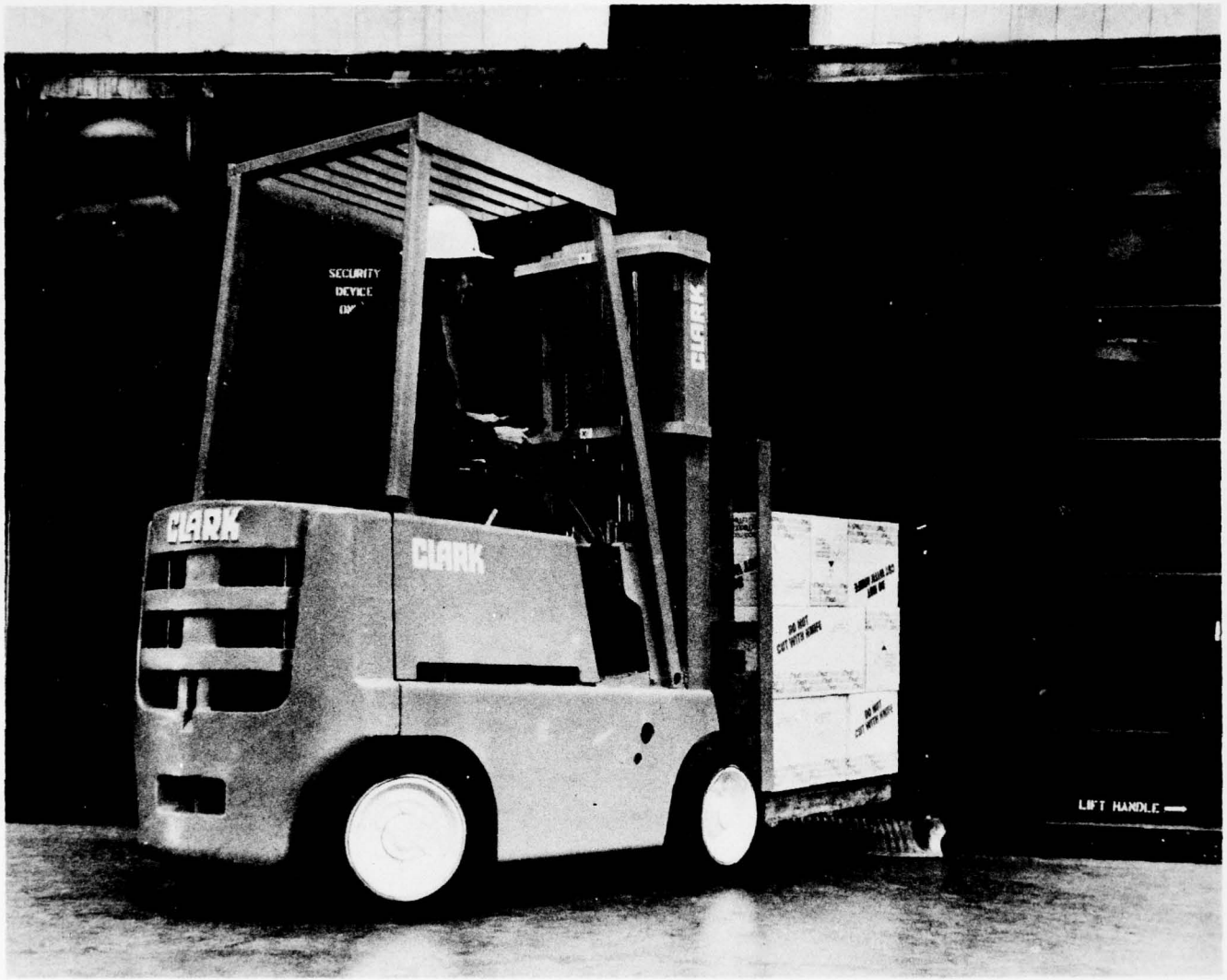


Figure 3. Clark forklift truck, Model C300-40.

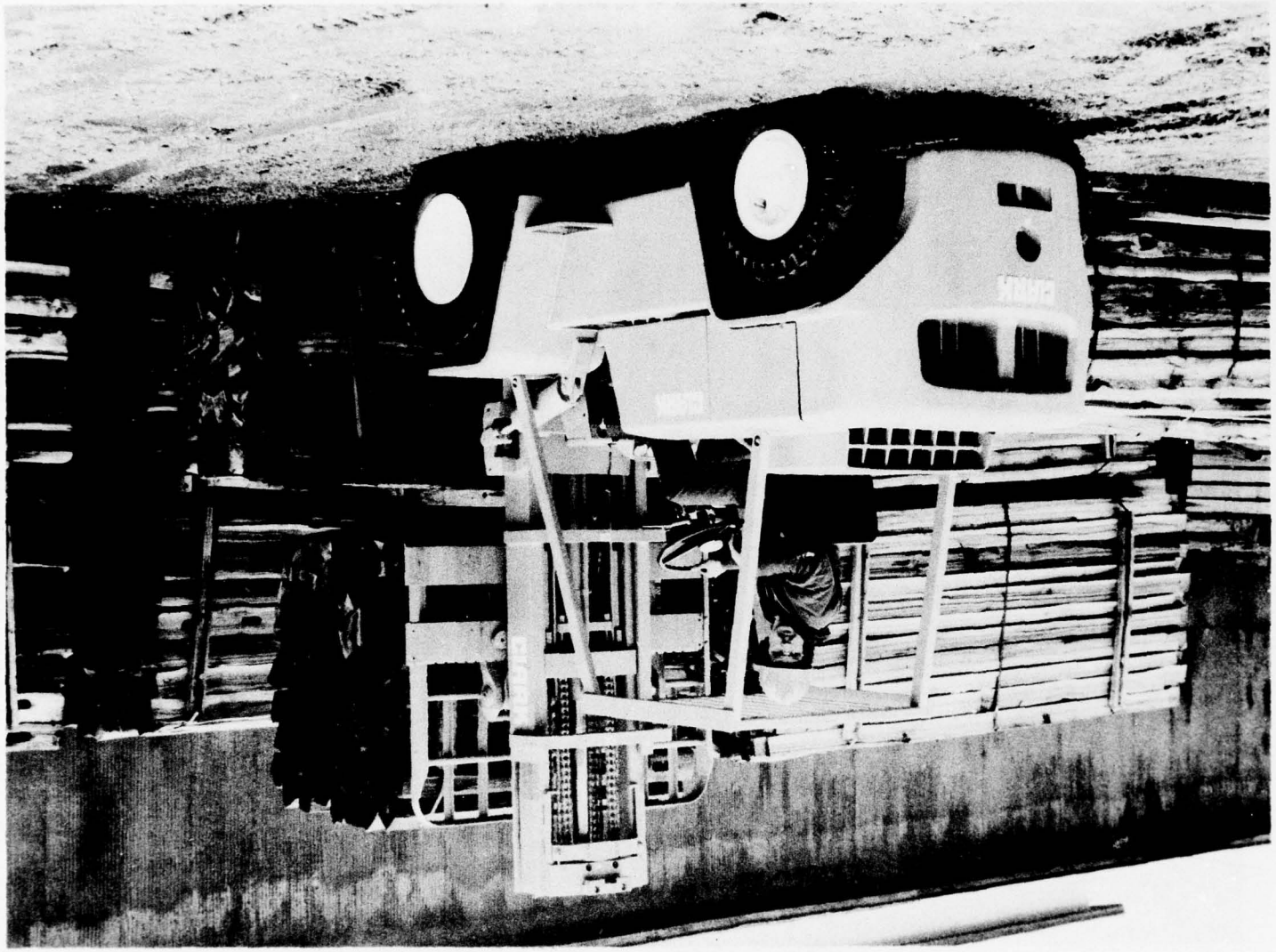


Figure 4. Clark forklift truck, Model C500-Y70.

Figure 5. Hyster forklift truck similar to Model S50C.

Figure 6. Hyster forklift truck, Model H70C.

Figure 7. Towmotor forklift truck similar to Model T40B.

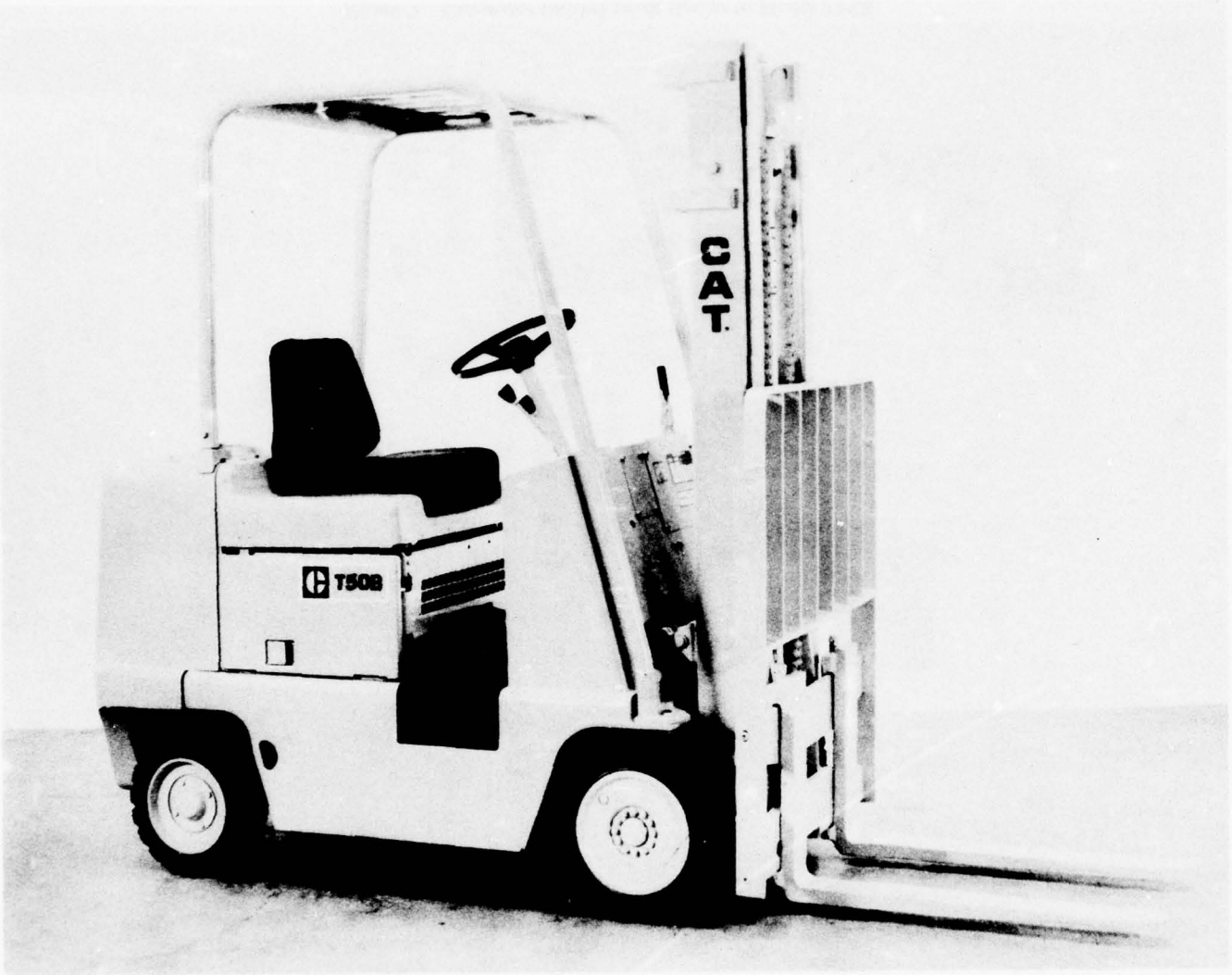


Figure 8. Towmotor forklift truck, Model T50B.

Figure 9. Towmotor forklift truck, Model V60B.

Figure 10. Forklift truck procured by using Military Specification MIL-T-52862.

a. Prepare the User Survey Questionnaire.

b. Conduct and report the User Survey.

II. USER SURVEY

5. Preparation of the User Survey Questionnaire. As discussed previously, the existing specification for this item, MIL-T-52862, was assumed to represent the requirement for forklift trucks. MERADCOM prepared a comprehensive questionnaire (Appendix A) to solicit from commercial users the data necessary to determine the extent to which commercial forklift trucks complied with this specification. Additional questions were added to determine Industry's life-cycle management philosophy for forklift trucks, to assess RAM, and to determine the manufacturer, dimensions, and part number of each major component.

6. Selection of Users to be Surveyed. The names of industrial users and their servicing dealers were obtained from four manufacturers surveyed previously. The program goal was to survey at least three major users of each forklift model proposed by the manufacturer. Twenty users (Table 2) were visited by the survey team. Survey team members included representatives from MERADCOM (engineering) and TARCOM (Quality Assurance/Maintenance). The survey team recorded the findings of their visits on the User Survey Questionnaires (Appendix A).

III. RESULTS OF USER SURVEY

7. Life-Cycle Management. All users were cooperative and attempted to provide the data solicited by the survey team. The compiled results from the User Survey Questionnaires are presented in Appendix B. A discussion of industrial users' life-cycle management policies for 4000-lb solid-rubber-tire (SRT) and 6000-lb pneumatic-tire (PT) forklift trucks follows:

a. Industry purchases each forklift truck for a specific task and equips it to match the work station environment. This is practical and cost-effective, as Industry generally can assume the forklift truck will be assigned to one work station all of it's economic life.

b. Industrial users are not committed to the concept of purchasing a forklift truck merely because it has the lowest initial cost. Instead, preference for a make/model, past performance, dealer location, dealer reputation, parts availability, and lowest cost to own were cited as reasons for purchasing a specific make/model. Obviously, quantifying these factors is difficult, especially when separate plants within the same corporation prefer different make/model forklift trucks. From user comments, this preference for a specific make/model can be related to two factors: the

dealer and the operator. A strong local dealer, able to support the user's vehicle logistically, regardless of make surveyed, definitely has an advantage when the user re-buys. Finally, based on preconceived feelings about a certain make/model of fork-lift truck, the operator/mechanic may question the acceptability of an alternate make/model. Therefore, if prices are within reason, users tend to buy for reasons other than initial cost.

Table 2. Industrial Users Surveyed and Manufacturers and Models Surveyed

			Manufacturer			
Type Fuel		User	Hyster	Clark	Towmotor	Allis-Chalmers
Diesel	A1	Port of Tacoma				ACP-70
LPG	A1	Port of Tacoma				ACC-55
LPG	C1	Borden, Inc.		C500-70		
LPG	C2	Citrus World		C500-50		
LPG	C3	Tropicana Prod.		C500-40		
				C500-55		
LPG	C4	Central Hardware		C300-40		
LPG	C5	Scotty's Ind.		C300-40		
LPG	H1	Champion Intl. Corp.	S50C			
LPG	H2	Hunt-Wesson Foods	S50C			
LPG	H3	Weyerhauser	S50C			
LPG	H4	Weyerhauser	H70C			
Gas	H5	Kaiser Alum. & Chem.	H60C			
Gas	H6	Kaiser Alum	H80C			
LPG	T1	Frontier Airlines			V55B	
Gas	T1	Kaiser Alum			V60B	
LPG	T2	High Resources, Inc.			T40B	
LPG	T3	Highland Resources, Inc.			T50B	
LPG	T4	Owens-Corning			T40B	
LPG	T5	Owens-Corning			T50B	
Diesel	T6	US Pipe & Foundry			V60B	

LPG – Liquefied Petroleum Gas

c. Table 3 reveals that only 50 percent of the users surveyed correctly stated the warranty provision for their forklift trucks. Two users specified a warranty period in excess of the manufacturer's standard warranty. This low awareness factor is indicative of Industry's general opinion that warranties are not important. This opinion can probably be traced to the rapport that has developed between the user/dealer. Users cited instances of dealers correcting failures which occurred beyond the warranty period. Such dealers typically are well considered when it's time to re-buy. However, several users experienced difficulty invoking the warranty because of agreements with their mechanics' unions. These agreements prohibit anyone other than union personnel from working on the user's equipment. In these instances, the dealer

and user would make some equitable arrangement to reimburse the user for the labor costs incurred to correct the failure.

Table 3. Various User Responses to User Survey Questionnaire Concerning Warranties of 4000-Pound SRT and 6000-Pound PT Commercial Forklift Trucks

User Response	Number of Users with This Response
Same as manufacturers' standard warranty.	8
Conflicts with manufacturers' standard warranty.	5
User did not know provisions of warranty.	4
User is lessor and did not know warranty provisions.	1
User specifies warranty.	2

d. The industrial users' acceptance procedures are lax by Government standards but are also indicative of their confidence in their local dealers. The dealer services the forklift truck and then delivers it to the user. The user, at most, may inspect the forklift truck to verify receipt of the make/model and optional equipment ordered. It is significant to note that even in large corporations which purchase through their national accounts offices, the forklift trucks are purchased from and delivered and serviced by local dealers.

e. Industrial users, in general, do not keep the (maintenance) records required to support an objective RAM assessment. Typically, the user charges a forklift truck with all of its maintenance time/parts/supplies, but when asked, most users could not discriminate between scheduled and unscheduled maintenance. Late in the program, lease-fleet operators were considered as a source of data to assess the RAM characteristics of these forklift trucks. A visit to one dealer with a large lease operation yielded the data shown in Table 4. These data were used to calculate the maintainability indices shown in Table 5 for commercial forklift trucks. As shown in Table 6, these values correlate favorably with the requirements from MIL-T-52862, the existing MACI specification. The values in Table 6 were derived using the same failure criteria. However, the test procedures are rigorous in the specification compared to the unknown of commercial use. This comparison validates the concept of commercial forklifts and supports the subjective evaluation of RAM using User Survey data.

Although an objective assessment of RAM could not be made using data from the user survey, a subjective evaluation is possible. Table 7 was prepared to highlight the user's response to several questions related to the RAM characteristics of the forklift trucks surveyed. The response indicates the general acceptability of

commercially available 4000-SRT/6000-PT forklift trucks, as 100 percent of the users stated they would re-buy the identical make/model.

Table 4. RAM Data from a Lease-Fleet Operator

Item	5000-lb Forklift	7000-lb Forklift
Total active maintenance time (man-hours)	200.00	220.0
Total operational time (hours)	10,000	10,000
Total number of scheduled and unscheduled maintenance actions	80	80
Total number of chargeable failures (requires 1 hour or more to repair)	20	20
Total man-hours to repair chargeable failures	110.0	130.0
Total scheduled and unscheduled maintenance time (clock-hours)	200.0	222.0
Number of vehicles in fleet	60	60

Table 5. 5000- and 6000-Pound-Capacity Forklift Trucks Maintainability Indices Calculated from Lease-Fleet Data

Item	5000-lb-Capacity Forklift	7000-lb-Capacity Forklift
Maintenance ratio (MR)	0.02	0.022
Mean time between failures (MTBF)	500	500
Mean time to repair failures	5.5	6.5
Availability (achieved)	0.98	0.98

Table 6. Commercial Maintainability Indices Versus Requirements of MIL-T-52862

Item	MIL-T-52862	Commercial 5000-lb-Capacity Forklift	Commercial 7000-lb-Capacity Forklift
Mean time between failures (hours)	100	500	500
Maintenance Ratio (MR)	0.06	0.02	0.022

Table 7. User Responses to RAM-Related Questions

Question	Unknown	Yes	No
1. Would you rebuy an identical make and model forklift truck?		20	
2. Are you dissatisfied with any features of this equipment?		7 (1) (3) (5) (7)	13
3. Are there any undesirable or unsatisfactory operating characteristics associated with this equipment?		2 (4) (8)	18
4. Does the forklift perform satisfactorily under the conditions where used?		20 (2)	
5. Are delays caused by part unavailability?	4		16
6. Can operators and/or maintenance personnel be trained without difficulty?		20	
7. Are there unduly difficult or time-consuming maintenance tasks which contribute to unavailability?	2	2 (6)	16
8. Are all components accessible for maintenance?	2	17	1
9. Have any difficulties been encountered using the maintenance literature?	2		18

(1) Poor visibility through mast.
(2) Overheats if radiator isn't cleaned frequently with compressed air.
(3) Brake/inching and accelerator are too close.
(4) Truck overheats.
(5) Replacing unsatisfactory slide masts with roller masts.
(6) R/R of water pump is difficult.
(7) Seal failure in hydraulic pumps permits an interchange of engine oil/hydraulic fluid.
(8) Retaining bolt to lift cylinder strips.

f. The maintenance times associated with frequently performed removal/replacement tasks were estimated by the users surveyed and are shown in Table 8. These items were averaged, and in Table 9 they have been compared to the maintenance times allocated in the existing specification (MIL-T-52862). As can be seen, these average times correlate well with the requirements from the existing specification.

Table 8. Average Time to Remove and Replace Frequently Replaced Components

User	Forklift	Removal/Replacement Time (Minutes) by Component						
		Hyd Pump	Starter	Voltage Regulator	Battery	Fan Belt	Brake Shoes	Alternator
C1	Clark C500 Y 70	180	120	60	60	60	640	120
C2	Northwestern C500 50	90	60	15	15	20	300	45
C3	C500 40/55	60	60	20	10	15	360	30
C4	C300 40	U	U	U	U	U	U	U
C5	C300 50	U	U	U	U	U	U	U
A1	ACC 55	U	U	U	U	U	U	U
A2	ACP70	U	U	U	U	U	U	U
T1	V55B	U	60	25	20	60	U	30
T2	T40B	135	35	17.5	10	60	120	35
T3	T50B	135	35	17.5	10	60	120	35
T4	T40B	120	60	15.0	15	30	360	15
T5	T50B	120	60	15	15	30	360	15
T6	V60B	90	45	30	5	30	60	30
H1	S50C	45	30	30	10	5	120	15
H2	S50C	45	120	10	10	30	240	120*
H3	S50C	120	45	10	10	10	240	45
H4	H70C	120	45	10	10	10	240	45
H5	H60C	120	20	10	10	20	120	U
H6	H80C	75	20	10	20	20	120	15

U – Unknown

* User standardizes on alternators and mounts standard alternator when OE fails. This retrofit time of 120 min. occurs once per vehicle with a non-standard alternator.

Table 9. Removal/Replacement Times from User Surveys Versus Requirements from the Existing Specification (MIL-T-52862)

Component Removed/Replaced	Removal/Replacement Time (Minutes)	
	User Survey	MIL-T-52862
Starter	50	60
Voltage Regulator	18	30
Battery	14	30
Fan Belt	29	75
Alternator	19*	30

* Estimate of Users C1 and H2 omitted.

g. Table 10 was prepared from survey results to highlight the distribution of various fuel types. Seventy-five percent of the users have equipped their forklifts to use LPG. Two users have diesel-powered, 6000-lb PT forklift trucks. It is significant to note that 85 percent of the users have selected a fuel type other than gasoline. This statistic becomes more impressive when one considers the program objective was to survey gasoline-powered forklifts which were difficult to find. The findings of this survey may signal that the Army should revalidate its requirement for gasoline-powered materials-handling equipment in lieu of LPG for the 4000-lb applications and/or diesel for 6000-lb and larger applications.

Table 10. Distribution of Fuel Types Used by Industrial Users Surveyed

Fuel Type	Number of Users
Gasoline	3
Diesel	2*
LPG	15

* Used in 6000-pound forklift trucks.

h. Most users either implicitly expect or explicitly state their equipment, when delivered, is to comply with all applicable State and Federal Safety Codes (including OSHA) and ANSI Safety Standards for powered industrial trucks. Only one user specified ". . . a maximum sound level not to exceed 96 dB(A) at full power, in an open area without reverberation and 70 dB(A) ambient . . . ." All users surveyed stated the sound level did not result in unusual operator fatigue after prolonged operations.

i. Finally, it should be noted that industrial users are not reluctant to specify equipment to match their requirement, even if it precludes competitive bidding. As examples, one user specified 2-stage air cleaners followed by an oil bath; another user specified vehicle to be compatible with glycol-based hydraulic fluid.

j. As discussed previously, industrial users are not committed to the philosophy of purchasing a forklift merely because it has the lowest initial cost. This stance was supported by reasons such as dealer proximity, good dealer service, good parts availability, and preference for a make/model. All of these reasons relate to the user's ability to logistically support his truck. It is interesting to note that two users, remote from any dealer, use manual transmissions which their mechanics can service/rebuild rather than automatic transmissions normally rebuilt by the dealer. Regardless of make/model, most users stated that part availability was 48 hours or less. However, all users avoided, whenever possible, the use of high-cost Original Equipment Manufacturer (OEM) parts by purchasing them from their local parts jobber. Preference for a make/model permits the industrial user to justify stocking a larger range of

spare parts (extra motor, transmission, etc.). This preference for a make/model also eliminates training problems; consequently, the industrial users were content with the manufacturers' publications.

k. In summary, the results of the manufacturers' survey and this survey have been analyzed and combined to derive a listing of the significant differences to be expected between MACI-type forklifts (MIL-T-52862) and commercial forklifts (MIL-T-52932). These differences are shown in Table 11.

Table 11. Significant Differences Expected Between Forklift Trucks Procured Using a Commercial Rather Than a MACI Specification

Feature	Commercial (MIL-T-52932)	MACI (MIL-T-52862)
Electromagnetic Interference requirement	No	Yes
Noise Level Specified	No	Yes
Diesel Engine Option (6000-lb)	No	Yes
Rain/Starting Test Demonstration	No	Yes
Hydraulic System Contamination Level Specified	No	Yes
Fungus and Moisture Resistance Specified	No	Yes
Rearward Tilt	6°	8°
Fork Length	42 in.	40 in.

IV. CONCLUSIONS

8. **Conclusions.** It is concluded that:

a. The RAM characteristics of the forklift trucks surveyed are acceptable to their industrial users.

b. Industrial users cite reasons other than lowest initial cost for purchasing a particular make/model forklift.

c. Industrial users purchase forklift trucks for a specific task in a known work station environment, and once purchased, a truck is assigned to that work station all of its economic life.

d. Industrial users are not hesitant to prepare a specification to match their requirement even if it precludes competitive pricing.

APPENDIX A

QUESTIONNAIRE FOR

USER EVALUATION OF COMMERCIAL FORKLIFT TRUCKS, PNEUMATIC- OR SOLID-RUBBER-TIRED, GASOLINE-ENGINE-DRIVEN, COMMERCIAL MATERIALS-HANDLING EQUIPMENT (CMHE)

USER:

NAME_____

ADDRESS_____

TELEPHONE_____

CONTACT_____

EVALUATORS:

NAME	ORGANIZATION

A. End Item:

1. Manufacturer_____
2. Model No._____
3. Date purchased_____
4. Capacity_____
5. Load center_____
6. Tires: SRT_____ PNEU._____

B. How was item purchased?

1. By specification: Sole Source_____Competitive Bid_____
2. By dealer or mfgr recommendation_____
3. From commercial brochure_____
4. Other_____
5. Was vehicle purchased new _____used_____

C. Components and Accessories:

1. Engine: Mfgr_____

   Model_____Year_____

   (a) Governor type (velocity, centrifugal):_____

   (b) Air cleaner mfgr, type, and part number:_____

_____

   (c) Positive crankcase ventilation system?_____Yes_____No

   (d) Cooling system: Capacity_____qt Pressure_____lb/in^2

   (e) Oil filter mfgr and part number:_____

   (f) Battery model, voltage, and capacity:_____

   (g) Alternator mfgr and part number:_____

   (h) Starter mfgr and part number:_____

2. Power Train:

   (a) Transmission mfgr and part number:_____

   (b) Front axle mfgr and part number:_____

3. Steering and Brakes:

   (a) Is power steering furnished?_____Yes_____No

(b) Is steering pump separate from main hydraulic pump?____Yes____No

(c) Power steering pump mfgr and part number:_____

(d) Power steering control unit mfgr and part number:_____

(e) Is power brake furnished?_____Yes_____No

(f) Brake valve mfgr and part number:_____

4. Hydraulic System:

(a) Filter mfgr and part number:_____

(b) Main pump mfgr and part number:_____

5. Uprights, forks, fork carrier, and load backrest:

(a) Mast roller or slider type?_____

(b) Number of mast stages:_____

(c) Mast part number:_____

(d) Load backrest type and part number:_____

(e) Sideshifter?_____Yes_____No

(f) Sideshifter mfgr and part number:_____

6. What instruments, gauges, and safety devices are furnished?

(a) Hourmeter:_____

(b) Ammeter: Gauge_____Light_____

(c) Engine coolant temperature: Gauge_____Light_____

(d) Engine oil pressure: Gauge_____Light_____

(e) Fuel gauge:_____

(f) Transmission pressure: Gauge_____Light_____

(g) Transmission temperature: Gauge_____Light_____

(h) Keyed ignition switch:_____

(i) Rear view mirror:_____

(j) Overhead guard:_____

(k) Load backrest:_____

(l) Horn:_____

(m) Floodlight(s)?_____Yes_____No_____Quantity

(n) Taillight?_____Yes_____No

(o) Directional lights?_____Yes_____No

(p) Parking brake?_____Yes_____No

(q) Tilt cylinder anti-cavitation?_____Yes_____No

(r) Neutral start switch?_____Yes_____No

(s) Starter disconnect?_____Yes_____No

7. What optional equipment is utilized?

(a) Sideshift:_____

(b) Retractable overhead guard:_____

(c) Attachments (clamps, ram):_____

(d) Special lights:_____

D. Functional Performance and Characteristics:

1. Geographical location (city and state):_____

2. Approximate time truck operates outdoors:_____

3. Is truck stored outdoors in cold climate?_____

4. Has there been any difficulty starting truck in cold weather?_____

5. Has the forklift been operated in any other environmental locations?

_____

6. Have there been any unusual environmental conditions (i.e., rain, contaminated areas, dirt)?_____

7. Did the forklift perform properly under these conditions?

_____

8. What, if any, actions were required to enable proper operations?

_____

E. Life-Cycle Information:

1. Date put in service:_____

2. Expected annual usage (hours):_____

3. Expected time between major overhauls (hours):_____

4. Expected life of the forklift (hours):_____

F. Characteristics:

1. Does the engine operate on unleaded fuel?_____

2. Is fuel filter provided?_____

3. What is the capacity of the fuel tank?_____

4. What is capacity of the cooling system?_____

5. Normal operating temperature range:_____

6. Air Cleaner System: Oil Bath_____Dry_____

7. Restriction Indicator? _____Yes_____No

8. Location of air intake:_____

9. Does the drive-train contain the following components:

   (a) Torque converter?_____Yes_____No

   (b) Power shift transmission?_____Yes_____No

   (c) Hydrostatic transmission?_____Yes_____No

   (d) Differential?_____Yes_____No

   (e) Positive inching?_____Yes_____No

   (f) External transmission filter?_____Yes_____No

   (g) Water cooler for transmission?_____Yes_____No

   (h) Universal joint drive shaft?_____Yes_____No

10. Electircal System:

   (a) Protected by:_____Circuit breakers?_____Fuses?

   (b) Alternator furnished?_____Generator furnished?_____

G. Compatibility with Related Equipment:

1. Transportation:

(a) Have you experienced difficulties in movement of this forklift to any job site?_____

(b) What kind of equipment have you used to transport the forklift?

_____

(c) Are lifting and/or tiedown attachments, or locations, provided for ease of shipment?_____

(d) What, if any, difficulties have been encountered?_____

_____

_____

2. Service Equipment:

(a) Are any special tools required for servicing this forklift? If so, what tools?_____

_____

_____

(b) Is any special equipment other than special tools required for this forklift?_____

(c) Have any difficulties been experienced in using various tools required for this forklift?_____

_____

(d) What tools have you used?_____

_____

H. Physical Characteristics:

1. Length w/forks:_____w/o Forks:_____
2. Width:_____
3. Overhead guard height:_____
4. Collapsed mast height:_____
5. Maximum fork height:_____
6. Free lift:_____
7. Backrest height:_____
8. Tilt forward:_____Rearward:_____
9. Sideshift left:_____Right:_____
10. Carriage width:_____
11. Fork dimension: Length:_____Width:_____Thickness:_____
12. Do forks comply with ANSI MH11.4 (Hook-type mount)?____Yes____No
13. Fork adjustment dimension (measured between outer edges of forks): Minimum:_____Maximum_____
14. Seat clearance to underside of overhead guard:_____in.
15. Wheel base:_____
16. Drive-tire tread width (C to C):_____

17. Steer-tire tread width (C to C):_____

18. Drive tire: Size:_____ Number:_____

19. Steer tire: Size:_____

I. Reliability, Availability, and Maintainability Characteristics:

1. General Data:

(a) Normal workday in clock-hours:_____

(b) Number of shifts per day:_____

(c) Total number of malfunctions requiring corrective maintenance:

_____

_____

(d) Total clock-hours expended to perform corrective maintenance:

_____

(e) Total man-hours expended to perform corrective maintenance:

_____

(f) Organizational:_____

(g) Dealer:_____

(h) Average downtime awaiting parts not in stock at dealer location:

_____

(i) What, if any, particular systems or component failures (trend) contribute more to non-availability?_____

_____

(j) Do special tools, repair parts, technical assistance, inadequacies in maintenance, or parts publications contribute more to non-availability?_____

_____

(k) Is non-availability contributed to by design deficiency or the need for a modification?_____

(l) What type of maintenance is performed by the:

(1) Operator?_____

_____

(2) Mechanics?_____

_____

(m) Are any components replaced on a scheduled basis? If so, what components and what intervals?_____

_____

(n) Are you dissatisfied with any features of the equipment or your relationship with the manufacturer or dealership? If so, specify:_____

_____

_____

_____

_____

(o) Are there any undesirable or unsatisfactory operating characteristics associated with the equipment? If so, specify:_____

_____

_____

_____

_____

(p) Since purchasing the forklift, have there been any modifications of a corrective or improvement nature made by:

(1) Manufacturer:_____

_____

_____

(2) Dealer:_____

_____

(3) In-House:_____

_____

(q) Have there been any significant design changes to this model item in the last year of which you are aware?_____

_____

(r) Do all compartments permit ready access to all items requiring periodic maintenance?_____

(s) Is replacement and adjustment of components and accessories accomplished with minimum drainage and/or distrubance to other components?_____

_____

(t) Is periodic maintenance accomplished with conventional, general-purpose tools normally associated with this type of equipment?_____

_____

(u) Are there any problems resulting from extreme weather conditions such as cold starting difficulties, entrance of rain water into the operating components, etc?

_____

_____

(v) Are there any maintenance tasks that are unduly difficult or time consuming that contribute to non-availability?_____

_____

_____

_____

J. Scheduled Maintenance: Please indicate the interval and average time required for one man using common tools and any special tools furnished with the unit to perform each of the following maintenance operations.

1. Replace Filters:
   - (a) Engine oil: Interval_____ Time_____
   - (b) Air: Interval_____ Time_____
   - (c) Fuel: Interval_____ Time_____
   - (d) Transmission: Interval_____ Time_____
   - (e) Hydraulic: Interval_____ Time_____
2. Drain and refill:
   - (a) Engine Oil: Interval_____ Time_____
   - (b) Transmission Oil: Interval_____ Time_____

(c) Hydraulic Oil: Interval_____ Time_____

(d) Cooling System: Interval_____ Time_____

3. Lubrication: Interval_____ Time_____

(a) Preventative Maintenance Time:

(1) Man-hours expended for daily servicing (average):_____

(2) Man-hours expended for weekly preventative maintenance service (average):_____

(3) Man-hours expended for monthly preventative maintenance service (average):_____

K. Component Part Replacement Data: Please indicate the average time required for one man using common tools and special tools furnished with the unit to perform each of the following maintenance operations. The average time to remove and replace is as follows:

1. *Alternator*:_____
2. Starter:_____
3. Voltage regulator:_____
4. Battery:_____
5. Fan belt:_____
6. Hydraulic pump:_____
7. Brake shoes:_____

L. Safety and Human Factors (User Comments)

1. Are the safety precautions provided by the manufacturer augmented by the user?_____

2. Do you know of any safety hazards that exist during:

(a) Operation:_____

(b) Maintenance:_____

3. Are the following safety and human factors items/elements, furnished as standard or optional equipment, adequate:

(a) Gauges and monitors:_____

(b) Controls that are within easy reach and clearly marked as to their use and function?_____

(c) Anti-skid walkway surface:_____

4. Does the size of the operator inhibit his performance?_____

5. Do any safety hazards exist?_____

6. Does the forklift operate with any hazardous handling characteristics?

_____

7. Does the sound level result in unusual operator fatigue after prolonged operation?_____

8. Is any special training required for:

(a) Operators?_____

(b) Maintenance personnel?_____

M. Manuscripts, Manuals, Tools, and Test Equipment (User Comments):

1. Were operator, maintenance, and parts manuals furnished with the item of equipment?_____

2. Are technical bulletins provided periodically by:

(a) Dealer:_____

(b) Manufacturer:_____

3. Do you use the commercial manual as supplied by the manufacturer/dealer or specify particular format and material? Have any difficulties been encountered in using the manuals as a reference in the following areas:

(a) Operating/setup instructions?_____

(b) Servicing instruction?_____

(c) Adjustments?_____

(d) Repair and Maintenance?_____

4. Are special tools required by operators or mechanics to maintain or test/troubleshoot any portions of the equipment? If so:

(a) Are special tools provided by the manufacturer?_____

(b) Are special tools described in the manual?_____

(c) Is the use of special tools sufficiently described in the operator/repair manual?_____

N. Training and Logistic Support (User Data):

1. Are dealer repairs effected on a timely basis?_____

2. Do you experience any difficulty in training operator and/or maintenance personnel?_____

3. Is timely technical assistance available when required:

(a) From the Dealer?_____

(b) From the Manufacturer?_____

4. Would you purchase like additional and/or replacement items? If not, why?

_____

_____

5. Do you attempt to standardize makes and/or models of equipment/components within your fleet?_____

6. What is the length of warranty in equipment hours/months?_____

_____

7. What is the total number of warranty claims?_____

_____

8. Are delays frequently caused by the lack of timely receipt of repair parts?

_____

9. What repair parts do you keep on hand for this item? If none stocked, why?

_____

_____

10. What is the length of time to fill emergency orders when parts are not in dealers stock?_____

_____

11. What is the length of time to fill normal orders when parts are not in dealers stock?_____

_____

APPENDIX B

COMPILED RESULTS FROM SURVEY OF INDUSTRIAL FORKLIFT USERS

B-1. Compiled Results from Survey of Users of 4000- to 5000-Pound-Capacity Forklift Trucks

B-2. Compiled Results from Survey of Users of 5000- to 5500-Pound-Capacity Forklift Trucks

B-3. Compiled Results from Survey of Users of 6000- to 8000-Pound-Capacity Forklift Trucks

B-1. COMPILED RESULTS FROM SURVEY OF USERS OF 4000- TO 5000-POUND-CAPACITY FORKLIFT TRUCKS

1. Manufacturer	Clark	Clark	Clark	Towmotor	Towmotor	Towmotor	Towmotor	Hyster
Model No.	C300-40	C300-50	C500 40	T40B	T40B	T50B	T50B	S50C
Date Purchased	Apr 77		69-73	Oct 75	71-76	71-76	Oct 75	76-77
Capacity (lb)	4000	4450	4000	4000	4000	5000	5000	5000
Load Center (in.)	24	24	24	24	24	24	24	24
Tires	SRT	SRT	SRT	SRT	SRT	SRT	SRT	SRT
2. Procurement Procedure	Unk							
User Specification		X						X
Sole Source					X	X		
Competitive Bid		X	X	X			X	
Dealer Recommendation								
Manufacturer Recommendation								
From Commercial Brochure								X
Other			Past Performance		Past Experience	Past Experience		Past Experience
Vehicle Purchased:								
New	X		X	X	X	X	X	X
Used								
Vehicles Leased		X						
3. Components and Accessories								
Engine Manufacturer	TCM*	TCM	Waukesha	TCM	TCM	TCM	TCM	TCM
Engine Model	F163	F163	D176	F163	F163	F163	F163	Unk
Governor Type	Unk	Centrifugal	Vacuum	Mech Fly-Weight	Centrifugal	Centrifugal	Mech Fly-Weight	Mechanical
Air Cleaner Manufacturer	Fram	Fram	Unk	United 2-stage	United 2-stage	United 2-stage	United 2-stage	Donaldson single-stage

* TCM -- Teledyne Continental Motor

PCV System	Yes	Yes	Yes	Yes	No	No	Yes	No
Cooling System Capacity (Qt)	Std	11	11	11	11	11	11	22
Pressure (lb/in²)	Std	7	7	14	14	14	14	Std
Oil Filter Manufacturer	Clark	Fram	Clark	Unk	Cat	Cat	Unk	Wix
Battery Model	Clark	Clark	Clark	Quaker	Cat	Cat	Cat	Std
Voltage	Unk	12	12	Unk	12	12	Unk	12
Capacity (amp)	Unk	45	45	Unk	67	67	Unk	Unk
Alternator Manufacturer	Delco	Delco	Delco	Delco	Delco	Delco	Delco	Delco
Starter Manufacturer	Delco	Delco	Delco	Delco	Delco	Delco	Delco	Delco
4. Power Train								
Transmission Manufacturer	Clark	Clark	Clark	Unk	Cat	Cat	Unk	Hyster
Front Axle Manufacturer	Clark	Clark	Clark	Cat	Cat	Cat	Cat	Hyster
5. Steering & Brakes								
Power Steering Furnished	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Steering Pump Separate from Hydraulic Pump	No	No	No	Yes	Yes	Yes	Yes	Yes
Power Steering Pump Manufacturer	Std	Vickers	Vickers	Std	Unk	Unk	Std	Std
Power Steering Control Unit Manufacturer	Unk	Unk	Vickers	Unk	Saginaw	Saginaw	Unk	Std
Power Brake Furnished	No	No	No	No	No	No	No	No
Brake Valve Manufacturer	Unk	Unk	Clark	Unk	Wagner	Wagner	Unk	Std
6. Hydraulic System								
Filter Manufacturer	Unk	Unk	Clark	Unk	Purolator	Purolator	Unk	Unk
Main Pump Manufacturer	Vickers	Unk	Vickers	Unk	Borg-Warner	Borg-Warner	Unk	Std
7. Mast Assembly								
Mast Type	Roller	Roller	Roller	Roller	Roller	Roller	Roller	Roller
No. of Mast Stages	2	3	3	2	3	3	2	2

Sideshift	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Sideshift Manufacturer	N/A	N/A	Clark	Cat	Towmotor	Towmotor	Cat	Unk
8. Instruments, Gauges, and Safety Devices								
Hourmeter	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ammeter	Gauge	Gauge	Gauge	Gauge	Gauge	Gauge	Gauge	Gauge
Engine Coolant Temp	Gauge	Gauge	Gauge	Gauge	Gauge	Gauge	Gauge	Gauge
Engine Oil Pressure	Light	Light	Gauge	Gauge	Gauge	Gauge	Gauge	Gauge
Fuel Gauge	Yes (LPG)	Yes (LPG)	Yes (LPG)	Yes	Yes	Yes	Yes (LPG)	Yes
Transmission Pressure Indicator	No	No	No	No	Light	Light	No	No
Transmission Temp Indicator	No	No	Light	No	No	No	No	Gauge
Keyed Ignition Switch	Yes	Yes	Yes	Yes	Some	Some	Yes	Yes
Rear-View Mirror	No	No	No	No	No	No	No	No
Overhead Guard	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Load Backrest	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Horn	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Floodlight (Number)	No	No	Yes (2)	No	Yes (2)	Yes (2)	No	No
Taillight	No	No	No	No	No	No	No	No
Directional Lights	No	No	No	No	No	No	No	No
Parking Brake	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Tilt Cylinder Anti-Cavitation Valve	Std	Yes	Yes	Std	Std	Std	Std	Std
Neutral Start Switch	Yes	Yes	Yes	No	Yes	Yes	No	No
9. What Optional Equipment is Utilized								
Sideshift	No	No	Yes	No	Yes	Yes	Yes	Most Trucks
Retractable Overhead Guard	No	No	No	No	No	Yes	No	No
Attachments (Clamps, etc)	No	Carpet Rams	[illegible]mp [illegible]alpak	Carton Clamp	Carton Clamp Roll Clamp	Carton Clamp Roll Clamp	Unk	Roll Clamps
Special Lights	No	No	No	No	No	No	No	Yes

10. Functional Performance and Characteristics

Geographical Location	Tenn	Fla	Fla	Ark	Ohio	Ohio	Ark	Oreg
Approx Time Operated Outdoors (%)	50	40	None	5	20	20	5	10
Is Truck Stored Outdoors in Cold Climate	No	No	No	No	No	No	No	No
Is Truck Difficult to Start in Cold Weather	N/A	N/A	No	No	Yes	Yes	No	N/A
Is truck operated in any other environmental locations	Unk	Unk	Cold Storage	No	Sand Soda Ash	Sand Soda Ash	No	Yes
Is truck exposed to environmental conditions (rain, dust, etc)	No	Rain	Dust	No	Dust	Dust	No	Particle Board Plant
Did truck perform properly under these conditions	N/A	Yes	Overheated	N/A	Yes	Yes	N/A	Yes
What precautions taken to ensure acceptable operations	N/A	Caution for wet slick spots	Clean out radiator	N/A	Clean radiator each shift	Clean radiator each shift	N/A	Increased PM

11. Life-Cycle Information

Date put in service	Apr 77	76-77	69-73	Oct 75	71-76	71-76	Oct 75	76
Expected annual usage (hr)	1200	720	3000	1800	3240	3240	1800	2000
Expected time between major overhauls (hr)	Unk	Unk	Unk	Unk	10,000 to 13,000	10,000 to 13,000	Unk	6000 to 8000
Expected life of the truck	Unk	Unk	21,000 hrs	12,600 hrs	10 yr	10 yr	7 yr	8 yr

12. Characteristics:

Does engine operate on unleaded fuels	No (LPG)	No (LPG)	No (LPG)	No (LPG)	No (LPG)	No (LPG)	No (LPG)	No (LPG)
Is fuel filter provided	N/A	No	No	No	No	No	Unk	With LPG System
Capacity of fuel tank (lb)	36	33½	75	Unk	38	38	Unk	Unk
Ambient air Temp (°F)	Unk	18 to 100	80 to 95	Unk	-10 to 90	- 10 to 90	Unk	Unk
Air Cleaner System	Unk	Dry	Dry	Dry	Dry	Dry	Dry	Dry

Restriction Indicator	Unk	No	No	No	No	No	No	Yes
Location of Air Intake	Engine comp	Side	Side	Outside	Under seat	Under seat	From outside	Under hood
Does the Drive Train contain the Following Components:								
Torque Converter	Yes	Yes	Yes	No	No	No	No	No
Power Shift Transmission	Yes	Yes	Yes	No	No	No	No	No
Hydrostatic Transmission	No	No	No	No	Yes	Yes	No	No
Differential	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Positive Inching	Std	Yes	Yes	No	Yes	Yes	No	Unk
External Transmission Filter	Yes	Yes	Unk	No	yes	Yes	No	Unk
Water Cooler for Transmission	Yes	Yes	Yes	No	No	No	No	No
Universal Joint Drive Shaft	No	No	No	Yes	Yes	Yes	Yes	Yes
13. Electrical System:								
Protected by: Circuit Breakers Fuses	Fuses	Fuses	Fuses	Fuses	Fuses	Fuses	Fuses	Fuses
Alternator Furnished	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
14. Compatibility with Related Equipment:								
Transportation: Any difficulties in moving this truck to any job site	N/A	No	No	No	No	No	No	N/A
What kind of equipment is used to transport this truck	None	Flatbed	Flatbed	Shop-built trailers	Vans flatbeds	Vans flatbeds	Shop-built trailers	None
Are lifting and/or tie-down attachments provided for ease of shipment	Unk	Yes	Yes	No	No	No	No	Unk
Have any difficulties been encountered	Unk	None	None	None	None	None	None	Unk

Service Equipment: What special tools are required for servicing this truck	N/A	N/A	None	12-pt socket to remove U-joints	Tool for differential	Tool for differential	12-pt socket to remove U-joints	Unk
What special equipment other than special tools is required for this truck	None	None	For rebuild of trans	None	Floor lifts	Floor lifts	None	None
Have any difficulties been encountered using the various tools required for this truck	N/A	N/A	No	No	No	No	No	No
15. Physical Characteristics:								
Length w/Forks (in.)	123¾	128.6	130-3/8	124	130	134	131	125
w/o Forks (in.)	80	84.6	88-3/8	83.5	82	86	87.5	83
Width (in.)	42	41.5	43.5	38	43	43	43	38
Overhead Guard Ht. (in.)	83	83	82.8	81	81.5	83	81	79.8
Collapsed Mast Ht. (in.)		83	103	N/A	83	83	N/A	70
Max. Fork Ht. (in.)	130	189	232	130	187	192	130	151.5
Free Lift (in.)	16	62.5	80.0	16	48	53	16	21.5
Backrest Ht. (in.)	48	48	48	48	48	48	48	47.9
Tilt Forward (degrees)	6	4	4	6	4	3	6	6
Rearward (degrees)	10	6	6	12	6	8	12	12
Sideshift (in.)								
Left	N/A	N/A	4	4	4	4	4	4
Right	N/A	N/A	4	4	4	4	4	4
Carriage Width (in.)	38		40	38	37	42	38	42.9
Fork Diemnsions (in.)								
Length	42	48	42	38.5	48	48	43	42
Width	5	5	4	6	5	5	6	5
Thickness	1-7/8	2	2	1.5	1.75	1.75	1.5	1.5
Do the forks comply with ANSI MH 11.4 (Hook-Type Mount)	Yes	Yes	Yes	Unk	Yes	Yes	Unk	Unk
Fork Adjustment Diemnsions:								
Minimum (in.)	10	10	8	18	16	16	19¼	Unk
Maximum (in.)	35	36	36	36	48	48	33¾	Unk
Seat Clearance to Underside of Overhead Guard (in.)	38-3/8	39	40	38	40.5	40.5	38	Unk

Wheel Base (in.)	53	53	55	52	52	56	55	51
Drive Tire Tread Width (C to C) (in.)	33½	33	34.5	32	32	32	31	Unk
Steer Tire Tread Width (C to C) (in.)	32¼	32	32	33	33	33	33.5	Unk
Drive Tire Size	18 x 8 x 12-1/8	18 x 8 x 12.1	18 x 9 x 12.5	18 x 9 x 12-1/8	18 x 7 x 12.5	18 x 8 x 12.5	18 x 7 x 12-1/8	Unk
Number	2	2	2	2	2	2	2	Unk
Steer Tire Size	18 x 5 x 12-1/8	18 x 5 x 12.1	18 x 5 x 12.5	18 x 5 x 10.5	16 x 5 x 10.5	16 x 5 x 10.5	18 x 5 x 10.5	Unk
16. Reliability, Availability, and Maintainability Characteristics:								
General Data:								
Normal Workday in Clock-Hours	12	8	24	8	24	24	8	8
No. of shifts per day	1.5	1	3	1	3	3	1	1-3
Total no. of malfunctions requiring corrective maintenance	None	N/A	25/day	Unk	17 per day (76 trucks)		Unk	Unk
Total clock-hours expended to perform corrective maintenance	N/A	N/A	9	Unk	14 per day (76 trucks)		Unk	Unk
Total man-hours expended to perform corrective maintenance	Unk	Unk	45 per day	Unk	Unk	Unk	Unk	Unk
Organizational	None	Unk	All	All	All	All	All	All
Dealer	All	Unk	None	None	None	None	None	None
Average down time awaiting parts not in stock at dealer location	N/A	Unk	None	Very little	24-48 hr	24-48 hr	Very little	Unk
Any particular systems or component failures (trend) contributes more to non-availability	N/A	N/A	None	Clutches Gaskets	Masts	Masts	Clutches Gaskets Burnt Valves	None
Do special tools, repair parts, technical assistance, inadequacies in maint or parts pubs contribute more to non-availability	N/A	N/A	No	No	No	No	No	No

Is non-availability contributed to by design deficiency or the need for a modification?	No	No	No	No	No	No	No	No
What type of maintenance is performed by the:								
Operator	Checks fluid levels	None	None	Checks fluid levels	Clean radiators with air; perform *PM check each shift*		Checks fluid levels	None
Mechanics	Dealer performs all maint	Dealer performs all maint	All	All other	Everything except turn crankshafts		All other	All
Are any components replaced on a scheduled basis? If so, what components and what interval:	Unk	No	Yes. Alternator, starter carburetor coil ignition wires at rebuild	No	Replaces slider masts with roller masts		No	No
Are you dissatisfied with any features of the equipment or your relationship with the manufacturer or dealer (specify)?	No	No	No	No	No	No	No	Yes, Part availability
Are there any undesirable or unsatisfactory operating characteristics associated with this equipment (specify)?	No	Yes–Inching pedal & accelerator too close together	No	No	Yes–Hydrostatic foot pedal when first used takes time to coordinate with accelerator		No	No
Since purchasing the truck have there been any modifications of a corrective or improvement nature made by manufacturer?	No	No	Yes, uprights	No	Yes–Modified transmission control linkage in Servo Assembly		No	No
Dealer	No	No	No	No	No	No	No	No
In-house	No	No	No	No	Modified transmission to be towed		No	Changed location of oil filter; installed full-flow type
Is the user aware of any significant design changes to this model item in the last year?	Unk	No	Upright height increased to 240 in. std	Unk	Changing to roller masts		Unk	No

Are items requiring periodic maintenance accessible?	N/A	N/A	Yes	Yes	No. Ctrweight must be removed to replace water pump, belts hard to replace		Yes	Yes
Can components be replaced and adjusted with minimum drainage and/or disturbance to other components?	N/A	N/A	Yes	Yes	No	No	Yes	Yes
Can maintenance be performed with conventional general purpose tools normally associated with this type of equipment?	N/A	N/A	Yes	Yes	Yes	Yes	Yes	Yes
Are there any problems resulting from extreme weather conditions such as cold starting difficulties, entrance of rain water into the operating components, etc.?	N/A	No	No	No	Yes, hard starting, LPG-fueled trucks when temp is below 20°F		No	No
Are there any known *maintenance tasks that* are unduly difficult or time consuming that contribute to non-availability?	N/A	N/A	No	No	Yes, Replacing water Pump *& belts*		No	No

17. Scheduled Maintenance:

Indicate the interval and average time required for one man to perform each of the following maintenance operations:

Replace Filters:								
Engine Oil	Monthly	Unk	200 hr	400 hr	28 days	28 days	900 hr	3 weeks
Time	Unk	N/A	5 min	5 min	10 min	10 min	5 min	30 min
Air	Monthly	N/A	200 hr	500 hr	28 days	28 days	500 hr	None set
Time	Unk	N/A	5 min	5 min	5 min	5 min	5 min	Unk
Fuel	Monthly	N/A	As needed	As Needed	28 days	28 days	As needed	None set
Time	Unk	N/A	5 min		10 min	10 min	Unk	Unk
Transmission	Monthly	N/A	200 hr	As needed	28 days	28 days	As needed	None set
Time	Unk	N/A	5 min	Unk	10 min	10 min	Unk	Unk
Hydraulic	Unk	N/A	500 hr	700 hr	28 days	28 days	700 hr	None set
Time	Unk	N/A	30 min	15 min	30 min	30 min	15 min	Unk
Drain & Refill:								
Engine Oil	Monthly	N/A	200 hr	450 hr	28 days	28 days	450 hr	3 wk
Time	Unk	N/A	10 min	20 min	20 min	20 min	20 min	10 min

Transmission oil	Unk	N/A	As required	900 hr	None	None	900 hr	None set
Time	Unk	N/A	15 min	30 min	Unk	Unk	25 min	Unk
Hydraulic Oil	Unk	N/A	As required	1500 hr	None	None	1500 hr	None set
Time	Unk	N/A	30 min	30 min	Unk	Unk	30 min	Unk
Cooling System	Unk	N/A	As required	Annually	Annually	Annually	Annually	None set
Time	Unk	N/A	15 min	15 min	15 min	15 min	15 min	10 min
Lubrication	Monthly	N/A	200 hr	450 hr	28 days	28 days	450 hr	3 wk
Time	Unk	N/A	60 min	30 min	20 min	20 min	30 min	30 min
Preventative maintenance Time: Man-hours expended for daily services (Av)	Unk	Unk	9 hr/fleet	Complaints only	10 min/truck	10 min/truck	Complaints only	None
Man-hours Expended for Weekly Preventative Maintenance Service (Av)	No records	Unk	50 hr/fleet	Unk	1 hr/truck	1 hr/truck	Unk	None
Man-hours Expended for Monthly Preventative Maintenance Service (Av)	N/A	Unk	200 hr/fleet	Unk	4 hr/truck	4 hr/truck	Unk	2 hr

18. Component Replacement Data:

Indicate the average time (min) required for one man to remove and replace:

Alternator	N/A	N/A	30	35	15	15	35	45
Starter	N/A	N/A	60	35	60	60	35	45
Voltage Regulator	N/A	N/A	20	20	15	15	20	10
Battery	N/A	N/A	10	10	15	15	10	10
Fan Belt	N/A	N/A	15	60	30	30	60	10
Hydraulic Pump	N/A	N/A	60	150	120	120	150	120
Brake Shoes	N/A	N/A	360	120	360	360	120	240

19. Safety and Human Factors: (User Comments)

Do you augment the manufacturers safety precautions?	No	Yes	Yes	Yes	No	No	Yes	No

Do you know of any safety hazards that exist during?

Operation	No	Yes Inching Pedal	No	No	No	No	No	No

Maintenance	N/A	No	No	No	No	No	No	No
Are the following safety and human-factors items/elements furnished as standard or optional equipment adequate?								
Gauges and Monitors	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls within easy reach & clearly marked	Markings obliterated	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Anti-skid walkway surface	No	Yes	Yes	Yes	Not on all trucks		Yes	Yes
Does the operator's size inhibit his performance?	No	No	No	No	No	No	No	No
Do any safety hazards exist?	No	No	No	No	No	No	No	No
Does the truck operate with any hazardous handling characteristics?	No	No	No	No	No	No	No	No
Does the sound level cause operator fatigue after prolonged operation?	No	No	No	No	No	No	No	No
Is special training required for:								
Operators?	No	No	No	No	yes 6 hr	yes 6 hr	No	No
Maintenance Personnel?	N/A	N/A	No	No	yes cat school	yes cat school	No	No
20. Manuscripts, Manuals, Tools, and Test Equipment (User Comments):								
Were operator, maintenance, and parts *manuals furnished with* the item of equipment?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Have any difficulties been encountered using the manuals as a reference in the following areas:								
Operating/Setup Instructions	NA	No	No	No	No	No	No	Yes
Servicing Instructions	N/A	N/A	No	No	No	No	No	Yes
Adjustments	N/A	N/A	No	No	No	No	No	Yes
Repair and Maintenance	N/A	N/A	No	No	No	No	No	Yes

Are special tools required by operators or mechanics to maintain or test/ troubleshoot any portions of the equipment?	N/A	N/A	Yes	No	Yes	Yes	No	No
Are special tools provided by the manufacturer?	Unk	Unk	Yes	N/A	Purchased from the manufacturer		N/A	N/A
Are special tools described in the manual?	Unk	Unk	Yes	N/A	Only in the service manual		N/A	N/A
Is the use of special tools sufficiently described in the operator/repair manual?	Unk	Unk	Yes	N/A	No In the service manual only		N/A	N/A
21. Training and Logistic Support:								
Are dealer repairs performed promptly?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Not always
Any difficulty in training operator and/or maintenance personnel?	No	No	No	No	No	No	No	No
Is timely technical assistance available when required?								
From Dealer	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
From Manufacturer	Not required	Yes	Yes	Unk	Yes	Yes	Unk	Yes
Would you purchase additional and/or replacement items?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes, except for parts availability
Do you attempt to standardize names and/or models of equipment/components within your fleet?	Unk	Yes	Yes	Yes	Yes	Yes	Yes	Yes
What is the length of warranty in equipment hours/months?	Unk	Leased	500 hr or 90 days	Unk	500 hr on engine 30 days parts & labor		Unk	90 days
What is the total number of warranty claims?	None	Unk	5	Unk	Very few	Very few	Unk	Unk

Are delays frequently caused by the lack of timely receipt of repair parts?	Unk	No	No	No	No	No	No	Unk
What repair parts do you keep on hand for this item? If none stocked, why not?	None; dealer performs all maint	None; dealer performs all maint	Almost all parts stocked	Clutches, fanbelts, points, valves, plugs	Everything except frame & masts		Clutches, belts, points, coil, plugs, valves	Starters, clutches, trans
What is the length of time to fill emergency orders when parts are not in dealers stock?	Unk	Unk	48 hr	Less than 48 hr	24 hr	24 hr	Less than 48 hr	1 day to 3 wk
What is the length of time to fill normal orders when parts are not in dealers stock?	Unk	Unk	10-15 days	Less than 48 hr	48 hr	48 hr	Less than 48 hr	1 day to 3 wk

B-2. COMPILED RESULTS FROM SURVEY OF USERS OF 5000- TO 5500-POUND-CAPACITY FORKLIFT TRUCKS

1. Manufacturer	**Hyster**	**Clark**	**Clark**	**Hyster**	**Clark**	**Towmotor**	**AC**
Model No.	S50C	C500-50	C500-50	S50C	C500-55	T55B	ACC55
Date Purchased		66-76	72	76	69-73	76	73-74
Capacity (lb)	5000	5000	5000	5000	5500	5500	5500
Load Center (in.)	24	24	24	24	24	24	24
Tires	SRT	SRT	SRT-Pneu	SRT	SRT	PNEU	SRT
2. Procurement Procedure							
User Specification	X						X
Sole Source				X			
Competitive Bid	X	X	X	X (depending on location)	X		X
Dealer Recommendation						X	
Manufacturer Recommendation							
From Commercial Brochure				Generally, no			
Other		Demo by dealers	Past history		Past performance		Own spec
Vehicle Purchased: New Used	X	X	X	X	X	X	X
Vehicles Leased			Yes	Short term only			
3. Components and Accessories:							
Engine Manufacturer	TCM*	Waukesha	Std	TCM	Waukesha	TCM	TCM
Engine Model	Std	D-1766	Std	F-163	D-176	Std	AC 153
Governor Type	Mechanical	Centrifugal	Centrifugal	Std	Vacuum	Mechanical	Mechanical
Air Cleaner Manufacturer	Std	Unk	Std	Std	Unk	United	United
PCV System	Std	Yes	Yes	Std	Yes	Unk	No
Cooling System Capacity	Std	11 qt	10 qt	Std	11 qt	Std	Std
Pressure (lb/in^2)	Std	7	Unk	Std	7	Std	Std

* *TCM – Teledyne Continental Motor*

Oil Filter Manufacturer	Std	Clark	Std	Std	Clark	Motorcraft	AC P3
Battery Model	Std	Clark	Std	Std	Unk	Astrolite	Std
Voltage	12	12	12	12	12	12	12
Capacity (amp)	Std	Unk	Std	Std	45	55	Std
Alternator Manufacturer	Std	Delco	Std	Std	Delco	Std	Delco
Starter Manufacturer	Std	Delco	Std	Std	Delco	Std	Delco
4. Power Train							
Transmission Manufacturer	Std Auto	Clark	Std	Std	Clark	Cat	Std
Front Axle Manufacturer	Std	Clark	Std	Std	Clark	Std	Std
5. Steering and Brakes							
Power Steering Furnished	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Steering Pump Separate from Hydraulic Pump?	Yes	Yes	Unk	Yes	No	Unk	No
Power Steering Pump Mfgr	Std	Vickers	Std	Std	N/A	Unk	N/A
Power Steering Control Unit Manufacturer	Std	Clark	Std	Std	Vickers	Std	Std
Power Brake Furnished	No	No	Unk	Yes	No	Unk	No
Brake Valve Mfgr	Std	Clark	Std	Std	Clark	Unk	Std
6. Hydraulic System							
Filter Manufacturer	Std	Clark	Std	Std	Clark	Std	Std
Main Pump Manufacturer	Std	Vickers	Std	Std	Vickers	Std	Std
7. Mast Assembly							
Type	Roller	Roller	Roller	Roller	Roller	Roller	Roller
No. of Mast Stages	3	3	3	3	3	2	2
Sideshift	Yes	Yes	No	No	Yes	No	Yes
Sideshift Manufacturer	Cascade	Clark	N/A	N/A	Clark	N/A	Unk
8. Instruments, Gauges, and Safety Devices							
Hourmeter	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ammeter	Gauge	Gauge	Gauge	Light	Gauge	Gauge	Gauge
Engine Coolant Temp	Gauge	Gauge	Gauge	Light	Gauge	Gauge	Gauge

Engine Oil Pressure	Gauge	Gauge	Gauge	Light	Gauge	Gauge	Gauge
Fuel Gauge	LPG	Yes	LPG	LPG	LPG	LPG	Yes
Transmission Pressure Indicator	Unk	No	No	No	No	No	No
Transmission Temp Indicator	Unk	No	No	No	Light	No	Light
Keyed Ignition Switch	Yes	Yes	Yes	Yes	Yes	No	Yes
Rear-View Mirror	No	No	No	No	No	No	No
Overhead Guard	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Load Backrest	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Horn	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Floodlight (Number)	Yes; user installed	Yes; user installed	No	No	Yes (2)	No	No
Taillight	Yes	No	No	No	No	No	No
Directional Lights	No	No	No	No	No	No	No
Parking Brake	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Tilt Cylinder Anticavitation valve	Yes	Yes	Unk	Yes	Yes	Yes	Std
Neutral Start Switch	Yes	Yes	Yes	Yes	Yes	No	Yes
Starter Disconnect	Unk	Yes	Yes	Yes	Yes	Unk	No
9. Optional Equipment Used:							
Sideshift	Yes	Yes	No	No	Yes	No	Yes
Retractable Overhead Guard	No	Yes	Yes	No	No	No	No
Attachments (Clamps, etc.)	Push-pull attachment	Clamps, pull pack	None	Yes	Clamp, pull pack	No	Yes
Special Lights	Revolving caution	No	Revolving caution	Revolving caution	No	Yes	None
10. Functional Performance and Characteristics							
Geographical Location	Nationally	Fla	Ohio	Ohio	Fla	Colo	Wash
Approx Time Operated Outdoors	Very little	5%	20%	None	None	5%	10%
Is truck stored outdoors in cold climate?	No	N/A	Sometimes	No	No	No	No
Is truck difficult to start in cold weather?	N/A	No	Yes	No	No	No	No

Is truck operated in any other environmental locations?	Yes-Refinery	Yes-Cold Storage	No	No	Yes-Cold Storage	No	No
Is truck exposed to unusual environmental conditions (rain, dust, etc.)?	Yes	Freezers, Mill	No	No	Dust	No	No
Did truck perform properly under these conditions?	Yes	Yes	N/A	N/A	Overheated	N/A	N/A
What precautions are taken to ensure acceptable operation?	None	Clean radiator frequently	N/A	N/A	Clean radiator frequently	N/A	N/A
11. Life Cycle Information:							
Expected Annual Usage (hr)	1600	4000	4-5000	2500	3000	4000	2000
Expected Time Between Major Overhaul (hr)	6000 to 8000	12,000	Unk	No overhaul	Unk	Unk	Depends on where used
Expected Life of the Truck	6 yr	20,000 hr	5 yr	10,000 to 15,000 hr	21,000	Unk	7 yr
12. Characteristics:							
Does engine operate on unleaded fuels?	No. LPG	No. LPG	No. LPG	No. LPG	No. LPG	No. LPG	No. LPG
Is fuel filter provided?	Unk	No	No	No	No	Unk	No
Capacity of fuel tank	33½ lb	7.7 gal	35 lb	33½ lb	75 lb	43.5 lb	Unk
Ambient Air Temperature Range	Varies as to location	40° to 100°F	Unk	Unk	80° to 95°F	Unk	Unk
Air Cleaner System	Dry	Dry	Dry	Dry	Dry	Dry	Dry
Restriction Indicator	No	No	No	Yes	No	Yes	Yes
Location of Air Intake	Under hood	Side	Under hood	Under hood	Side	Through hood	Inside engine comp.
Does the drive train contain the following components:							
Torque	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Power Shift Transmission	Yes	Yes	Yes	Yes	Yes	No	Yes
Hydrostatic Transmission	No	No	No	No	No	Yes	No
Positive Inching	Unk	Yes	Yes	Yes	Yes	No	No
External Transmission Filter	Std	Yes	Yes	Yes	Unk	Unk	No
Water Cooler for Transmission	Unk	Yes	Yes	Yes	Yes	Yes	Yes
Universal Joint Drive Shaft	Std	No	Yes	No	No	Yes	No

13. Electrical System							
Protected by: Circuit Breakers Fuses	Fuses	Fuses	Both	Fuses	Fuses	Fuses	Fuses
Alternator Furnished	Yes	Yes	Yes	Yes	Yes	Yes	Yes
14. Compatibility with Related Equipment							
Transportation:							
Any difficulties in moving this truck to any job site?	Not transported	No	No	No	No	No	Yes
What kind of equipment is used to transport this truck?	N/A	Tilt bed trailer	Comm. carrier	Semi-trailer flat bed unit		N/A	Low profile trailer
Are lift and/or tiedown attachments provided for ease of shipment?	N/A	Yes	Unk	Tiedowns	Yes	N/A	No
Any difficulties been encountered using these tiedowns?	N/A	None	Unk	Shifting of truck	None	N/A	N/A
Service Equipment:							
What special tools are required for servicing this truck?	None	Clutch alignment tool	N/A	None	None	None	None
What special equipment other than special tools is required for this truck?	None	None	Tubing wrench	None	Required, type Unk	None	None
Have any difficulties been encountered using the various tools required for this truck?	N/A	N/A	No	N/A	No	N/A	N/A
15. Physical Characteristics							
Length w/Forks (in.) w/o Forks (in.)	125 83	130-3/8 88-3/8	133.3 88.3	116 to 146 86.0	130-3/8 88-3/8	146 102	127 83.5
Width (in.)	38	43.5	43	41	43.5	47.5	42
Overhead Guard Ht (in.)	79.8	82.88	82.9	82.6	82.8	88	79
Collapsed Mast Ht (in.)	70	83.0	82.9	83.0	103	76.5	78.5
Max. Fork Ht (in.)	151.5	187	187	187.5	232	106	Unk
Free Lift (in.)	21.5	62.6	62	33.5	80	20	Unk
Backrest Ht (in.)	47.9	48.0	48.0	48.2	48	48	Std

Tilt Forward (degrees)	6	4	6	6	4	Std	Std
Rearward (degrees)	12	6	10	12	6	Std	Std
Sideshift (in.)			N/A	N/A		N/A	
Left	4	4			4		Unk
Right	4	4			4		Unk
Carriage Width (in.)	42.9	37	43	36	40	45¼	38.5
Fork Dimensions (in.)							
Length	42	42	42	30-60	42	42	42
Width	5	5.5	5.5	5.0	4	5	4.5
Thickness	1.5	1.75	1.75	1.5	2	1-7/8	1.5
Do the forks comply with ANSI MH11.4 (hook-type mount)?	Yes	Yes	Unk	Unk	Yes	Yes	Yes
Fork Adjustment Dimensions:							
Minimum (in.)	10	10	10	10	8	10	8.5
Maximum (in.)	35	36	36	35	36	42	35
Seat Clearance to Underside of Overhead Guard (in.)	Unk	40	39.5	39.0	40	39	37
Wheel Base (in.)	51	55	53	51.0	55	66.5	49.5
Drive Tire Tread Width (C to C) (in.)	32.0	34.5	34.5	32	34.5	39¾	31.5
Steer Tire Tread Width (C to C) (in.)	34.0	32.0	32.0	34	32	34¾	33
Drive Tire Size	18 x 9 x 12.1	18 x 9 x 12.12	Std	18 x 9 x 12.1	18 x 9 x 12.5	8.50 x 15	Std
Number	2	2	2	2	2	2	2
Steer Tire Size	16 x 6 x 10.5	18 x 5 x 12.12	Std	16 x 6 x 10.5	18 x 5 x 12.5	650 x 10	Std
16. Reliability, Availability, and Maintainability Characteristics							
General data:							
Normal workday in clock-hours	8	10-24	24	24	24	15-18	8
Number of shifts per day	1	2	3	3	3	3	1
Total number of malfunctions requiring corrective maintenance	Unk	12/day per fleet	3	2	25/day per fleet	3	Unk
Total clock-hours expended to perform corrective maintenance	Unk	6/day	2 to 6	1	9/day	Unk	Unk

Total man-hours expended to perform corrective maintenance	Unk	40/day	2-6/day	Unk	45/day	Unk	Unk
Organizational	All except leased trucks	All	PM only	All	All	All except eng/trans	All except trans
Dealer	None except all maint on leased trucks	None	All	None	None	Eng/trans only	Trans only
Average downtime awaiting parts not in stock at dealer location	Very little	3 days	1-10 days	No requirement; new truck	None	No problem	1-4 days
Any particular systems or component failures (trend) contributes more to non-availability	Unk	None	Carburetor inching	Uprights	N/A	N/A	Major engine parts
Do special tools, repair parts, technical assistance, inadequacies in maintenance or parts availability contribute more to non-availability?	Unk	No	No	Repair parts	No	No	No
Is non-availability contributed to by design deficiency or the need for a modification?	Unk	No	Unk	No	No	No	No
What type of maintenance is performed by the:							
Operator	None	Service check	None	Check fluid levels	None	None	None
Mechanics	All maint	All other	Routine PM	All other	All maint	All maint	All maint
Are any components replaced on a scheduled basis? If so, what components and what interval?	No	No	No	No	No	No	No
Are you dissatisfied with any features of the equipment or your relationship with the manufacturer or dealer? (Specify)	No	No	Yes. Electrical wire to use in explosive areas.	Yes; want better visibility	No	No	No
Are there any undesirable or unsatisfactory operating characteristics associated with the equipment? (Specify)	No	No	No	Yes; visibility	None	Yes; runs hot. Hand brake works improperly.	No

Since purchasing the truck have there been any modifications of a corrective or improvement nature made by:

Manufacturer	No	No	No	No	Yes; uprights	Yes. Moved radiator back ½ in.	No
Dealer	No	No	No	No	No	No	No
In-House	No	Installed lights	Installed lights	No	No	No	No
Is the User aware of any significant design changes to this model truck in the last year?	No	No	No	Yes	Yes; uprights increased to 240 in.	No	Yes. Using continental engine
Are all items requiring periodic maintenance accessible?	Yes	No	Yes	No	Yes	Yes	Yes
Can components and accessories be replaced and adjusted with a minimum drainage and/or disturbance to other components?	Yes	Yes	No; front brakes	No	Yes	Yes	Yes
Can periodic maintenance be performed with general-purpose tools normally associated with this type of equipment?	Yes	Yes	No	Yes	Yes	Yes	Yes
Are there any problems resulting from extreme weather conditions such as cold starting difficulties, entrance of rain water into the operating components, etc.?	No	No	Yes	No	No	No	No

17. Scheduled Maintenance

Indicate the interval and average time required for one man to perform each of the following maintenance operations:

Replace Filters:

Engine Oil	100 hr	120 hr	300 hr	200 hr	200 hr	300 hr	200 hr
Time	Unk	5 min	15 min	5 min	5 min	10 min	Unk
Air	250 hr	150 hr	300 hr	200 hr	200 hr	300 hr	1200 hr
Time	Unk	10 min	10 min	5 min	5 min	10 min	Unk
Fuel	Unk	N/A	300 hr	200 hr	As needed	300 hr	200 hr
Time	Unk	N/A	20 min	5 min	15 min	15 min	Unk
Transmission	250 hr	350 hr	300 hr	1000 hr	200 hr	200 hr	1200 hr
Time	Unk	5 min	15 min	5 min	5 min	15 min	Unk

Hydraulic	250 hr	6 mo	300 hr	1000 hr	500 hr	Unk	1200 hr
Time	Unk	30 min	30 min	60 min	30 min	Unk	Unk
Drain & Refill:							
Engine Oil	100 hr	60 hr	300 hr	200 hr	200 hr	300 hr	200 hr
Time	Unk	30 min	30 min	10 min	10 min	30 min	Unk
Transmission Oil	500 hr	12 mo	1200 hr	1000 hr	As required	2000 hr	1200 hr
Time	Unk	30 min	30 min	15 min	15 min	Unk	Unk
Hydraulic Oil	Unk	6 mo	1200 hr	1000 hr	As required	As required	1200 hr
Time	Unk	30 min	30 min	15 min	30 min	Unk	Unk
Cooling System	As required	As required	When needed	As needed	As required	Never	2400 hr
Time	Unk	30 min	15 min	10 min	15 min	N/A	Unk
Lubrication	100 hr	60 hr	300 hr	200 hr	200 hr	300 hr	200 hr
Time	Unk	30 min	20 min	10 min	60 min	60 min	Unk
Preventative Maintenance Time:							
Man-hours expended for daily servicing (Av.)	None	5 min	15 min	15 min	9 hr	5-10 min	5 min
Man-hours expended for weekly preventative maintenance service (Av.)	Unk	30 min	Unk	2 hr	50 hr (fleet)	Unk	Unk

18. *Component Part Replacement Data*

Indicate the average time (min) required for one man to remove and replace:

Alternator	120	45	120	15	30	30	Unk
Starter	120	60	120	30	60	60	Unk
Voltage Regulator	10	15	60	30	20	30	Unk
Battery	10	15	60	10	10	20	Unk
Fan Belt	30	20	60	5	15	120	Unk
Hydraulic Pump	60	90	180	45	60	Unk	Unk
Brake Shoes	240	300	480	240	360	Unk	Unk

19. Safety and Human Factors (User Comments)

Do you augment the manufacturer's safety precautions?	Yes	Yes	Yes	Yes	Yes	Yes	No
Do safety hazards exist during:							
Operation?	No	No	Visibility	No	No	No	No
Maintenance?	No	No	No	No	No	No	No

Are the following safety and human-factors items/elements furnished as standard or optional equipment adequate?

Gauges and monitors	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls within easy reach and clearly marked?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Anti-skid walkway surface	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Does the operator's size inhibit his performance?	No	No	No	No	No	No	No
Do any safety hazards exist?	No	No	No	No	No	No	No
Does the sound level cause operator fatigue?	No	No	No	No	No	No	No
Is training required for: Operators	Yes, with new models	Yes	Yes	No	No OJT	Yes	No
Maintenance Personnel	Yes, with new models	Yes	Yes	No	No	No	Yes

20. Manuscripts, Manuals, Tools, and Test Equipment (User Comments)

Were operator, maintenance, and parts manuals furnished with the item of equipment?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Are technical bulletins produced periodically by:							
Dealer?	Unk	Yes	No	No	No	Unk	Yes
Manufacturer?	Unk	Unk	No	No	No	Unk	No
Have any difficulties been encountered using the manuals as a reference in the following areas:							
Operating; setup instructions?	No	No	No	No	No	No	No
Servicing instruction?	No	No	No	No	No	No	No
Adjustments?	No	No	No	No	No	No	No
Repair & maintenance?	No	No	No	No	No	No	No
Are special tools required by operators or mechanics to maintain or test/troubleshoot any portions of the equipment?	No	Yes	Yes	Yes	Yes	No	No
Are special tools provided by the manufacturer?	N/A	No	No	Yes	Yes	N/A	N/A
Are special tools described in the manual?	N/A	Yes	No	Yes	Yes	N/A	N/A

Is the use of special tools adequately described in the operator/repair manual?	N/A	Yes	No	Yes	Yes	N/A	N/A
21. Training and Logistic Support							
Are dealer repairs performed promptly?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Any difficulty in training operator and/or maintenance personnel?	No	No	No	No	No	No	No
Is technical assistance available when required from dealer?							
From Dealer	Yes	No	Yes	Yes	Yes	Yes	Yes
From Manufacturer	N/A	No	Yes	Yes	Yes	Yes	Yes
Would you purchase like additional and/or replacement items?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Do you attempt to standardize names and/or models of equipment/components within your fleet?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
What is the length of warranty in equipment hours/months?	Unk	90 days *500 hr*	1 yr	90 days 500 hr	90 days 500 hr	6 mo	1 yr
What is the total number of warranty claims?	Unk	Very few	1	None	5	3	None
Are delays frequently caused by the lack of timely receipt of repair parts?	No	No	No	No	No	No	No
What repair parts do you keep on hand for this item? If none stocked, why not?	More than average due to nature of operation	Just about everything	General tune-up parts	Minor repair parts	Just about everything	Gas regulators, starters, alternator	None
What is the length of the time to fill emergency orders when parts are not in dealers stock?	72 hr	1 wk	1-10 days	2-3 wk	10-15 days	3 days or less	48 hr

B-3. COMPILED RESULTS FROM SURVEY OF USERS OF 6000- to 8000-POUND-CAPACITY FORKLIFT TRUCKS

1. Manufacturer	Towmotor	Towmotor	Hyster	Hyster	AC	Hyster
Model No.	V60B	V60B	H60C	H60C	ACP70	H80C
Date Purchased	76	73-76	67-76	76	73-74	76
Capacity (lb)	6000	5000 to 6500	6000	7000	7000	8000
Load Center	24 in.	24 in.	24 in.	24 in.	24 in.	24 in.
Tires	Foam-filled	Pneu	Pneu	Pneu	SRT	Pneu
2. Procurement Procedure						
User Specification	X	X	X	X	X	X
Sole Source		X		X		
Competitive Bid	Price not prime concern	X	X		X	X
Dealer Recommendation			X		X	X
Manufacturer Recommendation			X		X	X
From Commercial Brochure		X	X	X		
Other	Company evaluation	Past performance		Past experience		Prefer Hyster
Vehicles Purchased:						
New Used	X	X	X	X	X	X
3. Components and Accessories						
Engine Manufacturer	TCM* Specified	Perkins	TCM	TCM	AC Diesel	TCM
Engine Model	F227	4.236	Unk	Unk	Unk	Unk
Governor Type	Centrifugal	Velocity	Mechanical	Mechanical	Std	Mechanical
Air Cleaner Manufacturer	Farr	Farr	Unk	Donaldson	United	Unk
PCV System	Yes	Yes	No	No	No	Yes
Cooling System Capacity Pressure ($lb/in.^2$)	20 qt 7	20 qt 7	Std Std	22 qt Std	Std Std	Std Std
Oil Filter Manufacturer	Purolator	Purolator	Std	Wix	Std	Std

* TCM – Teledyne Continental Motor

Battery Model	Gould	Gould	Std	Std	Std	Std
Voltage Capacity (amp)	12 67	12 172	12 Unk	12 Unk	12 Unk	12 Unk
Alternator Manufacturer	Delco Heavy-Duty	Delco Heavy-Duty	N/A	Delco	Delco	Std
Starter Manufacturer	Delco	Delco Enclosed	Std	Delco	Delco	Std
4. Power Train						
Transmission Manufacturer	Std Hydrostatic	Std Hydrostatic	Std	Hyster	Std	Std
Front Axle Manufacturer	Towmotor	Towmotor	Std	Hyster	Std	Std
5. Steering & Brakes						
Power steering furnished?	Yes	Yes	Yes	Yes	Yes	Yes
Steering pump separate from hydraulic pump?	Yes	Yes	Yes	Yes	No	Yes
Power steering pump manufacturer	Eaton	Eaton	Std	Std	N/A	Std
Power steering control unit manufacturer	Ross	Ross	Std	Std	Std	Std
Power brake furnished?	No	No	Yes	No	No	Yes
Brake valve manufacturer	Wagner	Wagner	Std	Std	Std	Std
6. Hydraulic System						
Filter manufacturer	Walker	Walker	Std	Std	Std	Std
Main pump manufacturer	Borg-Warner	Borg-Warner	Std	Std	Std	Std
7. Mast Assembly						
Mast Type	Roller	Roller	Roller	Roller	Roller	Roller
Number of mast stages	Up to 4	1, 2, or 3	2	2	2	2
Sideshift	Yes	No	Yes	Yes	Yes	Yes
Sideshift manufacturer	Cascade	N/A	Unk	Unk	Unk	Unk
8. Instruments, Gauges, and Safety Devices						
Hourmeter	Yes	Yes	Yes	Yes	Yes	Yes
Ammeter	Gauge	Gauge	Light	Gauge	Gauge	Light

Engine Coolant Temperature	Gauge	Gauge	Light	Gauge	Gauge	Light
Engine Oil Pressure	Gauge	Gauge	Light	Gauge	Gauge	Light
Fuel Gauge	Yes	Yes	Yes	Yes	Yes	Yes
Transmission Pressure Indicator	No	No	No	No	No	Unk
Transmission Temp Indicator	No	No	No	Gauge	Light	Unk
Keyed Ignition Switch	Yes	Yes	Yes	Yes	Yes	Yes
Rear-view Mirror	No	No	No	No	No	No
Overhead Guard	Yes	Yes	Yes	Yes	Yes	Yes
Load Backrest	Std	Yes	Yes	No	Yes	Yes
Horn	Std	Yes	Yes	Yes	Yes	Yes
Floodlight(s)	Yes (2)	Yes (2)	No	No	No	No
Taillight	Yes	Yes	No	No	No	No
Directional Lights	No	No	No	No	No	No
Parking Brake	Yes	Yes	Yes	Yes	Yes	Yes
Tilt Cylinder Anti-cavitation Valve	No	No	No	Std	Std	Std
Neutral Start Switch	Yes	Yes	No	Yes	Yes	No
Starter Disconnect	Yes	Yes	No	No	No	No
9. Optional Equipment						
Sideshift	Yes	Yes	Yes	Yes	Yes	Yes
Retractable overhead guards	No	No	No	No	No	No
Attachments (clamps, etc)	Yes	No	No	Roll Clamps	Yes	No
Special Lights	Yes	No	None	Flashing Amber	None	None
10. Functional Performance and Characteristics						
Geographical Location	La	Tenn	Wash State	Oreg	Wash State	Wash State
Approx Time Operated Outdoors (%)	100	50-98	50	10	50	50
Is truck stored outdoors in cold climate?	No	Yes	No	No	No	No
Is truck difficult to start in cold weather?	No	No	N/A	N/A	No	N/A
Is truck operated in any other environmental locations?	Heavy dust Furnace areas	Furnace areas	No	Yes	No	No

Is truck exposed to unusual environmental conditions (rain, dust, etc.)?	Heavy dust	Dust, rain, fly ash, foundry, sand	No	Particle Plant dust	No	No
Did truck perform properly under these conditions?	Yes	Yes	N/A	Yes	N/A	N/A
What precautions are taken to ensure acceptable operation?	Farr Air Cleaners	Farr Dual-Stage Air Cleaners	N/A	Increased PM	N/A	N/A
11. Life-Cycle Information						
Expected annual usage (hr)	2100	6000	1000	2000	2000	1000
Expected time between major overhauls (hr)	10,000	12,000	Unk	8000	Unk	Unk
Expected life of the truck (hr)	10,000	40,000	5-7 yr	8 yr	7 yr	5-7 yr
12. Characteristics						
Does engine operate on unleaded fuels?	No	No, Diesel	No, LPG	No, LPG	No, Diesel	No, LPG
Fuel filter provided?	Yes	Yes	Std	Yes	Std	Std
Capacity of fuel tank	9.3 gal	9.3 gal	Unk	Unk	Std	Unk
Ambient air temperature	70-110°F	60-120°F	–	–	–	–
Air cleaner system	Dry	Dry	Dry	Dry	Dry	Dry
Restriction indicator	Yes	Yes	Yes	Yes	Yes	Yes
Location of air intake	On overhead guard	On top of ctrwt	Inside engine compartment	Under hood	Inside engine compartment	Inside engine compartment
Does the drive train contain the following components:						
Torque converter	No	No	No	No	No	Yes
Power shift transmission	No	No	No	No	Yes	Yes
Hydrostatic transmission	Yes	Yes	No	No	No	No
Differential	Yes	Yes	Yes	Yes	Yes	Yes
Positive inching	No	Yes	Yes	No	No	Yes
External transmission filter	Yes	No	No	No	No	Yes
Water cooler for transmission	Yes	Yes	No	No	Yes	Yes
Universal joint drive shaft	Yes	Yes	Yes	Yes	No	Yes

13. Electrical System						
Protected by:						
Circuit breakers/fuses	Fuses	Fuses	Fuses	Fuses	Fuses	Fuses
Alternator furnished	Yes	Yes	No (Generator)	Yes	Yes	Yes
14. Compatibility with Related Equipment						
Transportation						
Any difficulties in moving this truck to any job site?	Yes, hard to push or pull	Not transported	Not transported	Not transported	Yes	Not transported
What kind of equipment is used to transport this truck?	Larger FLT	N/A	N/A	N/A	Low-profile trailer	N/A
Are lifting and/or tiedown attachments provided for ease of shipment?	No	N/A	N/A	N/A	No	N/A
Have any difficulties been encountered?	As stated	N/A	N/A	N/A	None	N/A
What special tools are required to service this truck?	None	None	None	None	None	None
Have any difficulties been encountered using the various tools required for this truck?	Yes; close working area	No	No	No	No	No
15. Physical Characteristics						
Length w/Forks (in.)	148	148	157	152.8	Std	160.3
w/o Forks (in.)	106	106	107	110.8	Std	118.3
Width (in.)	47.5 to 59	47.5	53.5	54.3	54	54.3
Overhead Guard Ht (in.)	88	88 Std	83	83	86.5	83
Collapsed Mast Ht (in.)	Mast Ht varies	89 Std	84	Unk	Unk	Unk
Max Fork Ht (in.)	182	130	120	Unk	Unk	Unk
Free Lift (in.)	Depends on area of use	19	0	Unk	Unk	Unk
Backrest Ht (in.)	48 Std	48 Std	None	Unk	Std	Unk
Tilt Forward (degrees)	6 Std	6 Std	Std	Std	Std	Unk
Rearward (degrees)	12 Std	12 Std	Std	Std	Std	Unk
Sideshift (in.)	N/A	N/A	N/A			
Left				Unk	Unk	Unk
Right				Unk	Unk	Unk
Carriage width (in.)	45 Std	45 Std	48	48	48	48

Fork Dimensions (in.)						
Length	30-48	42-48	48	Unk	48	Unk
Width	5 Std	5	5	Unk	6	Unk
Thickness	1.75 Std	1.75	1-7/8	Unk	2	Unk
Do the forks comply with ANSI MH11-4 (Hook-Type Mount)?	Yes	Yes	Yes	Unk	Yes	Unk
Fork Adjustment Dimensions:						
Minimum (in.)	11.2 Std	10	18	Unk	Unk	Unk
Maximum (in.)	42	42	48	Unk	Unk	Unk
Seat Clearance to Underside of Overhead Guard (in.)	40 Std	40 Std	38	40.2 Std	39	40.2 Std
Wheel Base (in.)	66 Std	66 Std	65	65 Std	Std	75 Std
Drive Tire Tread Width (C to C) (in.)	45	45	45	44.4	44	44.4
Steer Tire Tread Width (C to C) (in.)	34.62	34.62	43.5	42.5	42	42.5
Drive Tire Size	8.15 x 15(s) 7.00 x 15(d)	8.15 x 15	8.25 x 15 x 12	Unk	8.25 x 15	Unk
Number	2 & 4	2	2	2	2	2
Steer Tire Size	6.50 x 10	6.50 x 10	7.00 x 12 x 12	Unk	7.50 x 10	Unk
16. Reliability, Availability, and Maintainability Characteristics						
General Data:						
Normal workday in clock-hours	15-18	24	8	8	8	8
Number of shifts per day	1 or 2	3	1	1-3	1	3
Total number of malfunctions requiring corrective maintenance	Unk	Unk	Unk	Unk	Unk	Unk
Total clock-hours expended to perform corrective maintenance	6	Unk	Unk	Unk	Unk	Unk
Total man-hours expended to perform corrective maintenance	6	Unk	Unk	Unk	Unk	Unk
Organizational	All	All	All	All	All	All
Dealer	None	Warranty only	Engine/trans rebuilt	None	Trans rebuild	Engine/trans rebuild
Average downtime awaiting parts not in stock at dealer location	Less than 8 hr	None	No more than 24 hr	1 day to 3 weeks	Less than 48 hr	No more than 24 hr
Any particular systems or component failures (trend) contribute more to non-availability	None	Tie-rod ends which have been corrected	Differential transmission components	None	Major engine parts	Differential transmission components

Is non-availability contributed to by design deficiency or the need for a modification?	No	No	No	No	No	No
What type of maintenance is performed by the:						
Operator	Checks fluid levels	None	Checks fluid levels	None	None	Checks fluid levels
Mechanics	Minor or major	All maint	All except engine rebuild	All maint	All maint	All except engine rebuild
Are any components replaced on a scheduled basis? If so, what components and what intervals?	No	No	No	No	No	No
Are you dissatisfied with any features of the equipment or your relationship with the manufacturer or dealer? (Specify)	No	No	No	Parts availability not good	No	No
Are there any undesirable or unsatisfactory operating characteristics associated with the equipment? (Specify)	No	No	Seal leak allows engine oil to mix with hydraulic oil	No	Location of battery	Seal leak allows engine oil to mix with hydraulic oil
Since purchasing the truck have there been any modifications of a corrective or improvement nature made by:						
Manufacturer	No	Yes	No	No	No	No
Dealer	No	Yes	No	No	No	No
In-House	No	Yes; welded muffler bracket	No	Changed location of oil filter	No	No
Is the user aware of any significant design changes to this model truck in the last year?	No	Yes; new ignition; moved air pick-up opening	No	No	No	No
Are items requiring periodic maintenance accessible?	Yes	Yes	Yes	Yes	Yes	Yes
Can components be replaced and adjusted with minimum drainage and/or disturbance to other components?	Yes	Yes	Yes	Yes	Yes	Yes
Can periodic maintenance be performed with general-purpose tools normally associated with this type of equipment?	Yes	Yes	Yes	Yes	Yes	Yes

Are there any problems resulting from extreme weather conditions such as cold starting difficulties, entrance of rain water into the operating components, etc.	No	No	No	No	No	No

17. Scheduled Maintenance

Indicate the interval and average time required for one man to perform each of the following maintenance operations:

Replace Filters						
Engine Oil	4 wk	Weekly	Weekly	3 wk	200 hr	Weekly
Time	10 min	5 min	30 min	30 min	Unk	20 min
Air	4 wk	Monthly	As needed	No Sched	1200 hr	As needed
Time	10 min	10 min	5 min	Unk	Unk	5 min
Fuel	As needed	Monthly	As needed	No sched	No sched	As needed
Time	10 min	15 min	10 min	Unk	Unk	10 min
Transmission	6 mo	Monthly	Annually	No sched	1200 hr	Annually
Time	20 min	5 min	10 min	Unk	Unk	10 min
Hydraulic	6 mo	Monthly	6 mo	No sched	1200 hr	6 mo
Time	20 min	5 min	30 min	Unk	Unk	30 min
Drain and Refill:						
Engine Oil	4 wk	Weekly	Weekly	3 wk	200 hr	Weekly
Time	20 min	15 min	10 min	10 min	Unk	10 min
Transmission Oil	6 mo	Annually	Annually	No sched	1200 hr	Annually
Time	20 min	10 min	30 min	10 min	Unk	30 min
Hydraulic Oil	6 mo	Yearly	No sched	No sched	1200 hr	No sched
Time	30 min	10 min	Unk	10 min	Unk	Unk
Cooling System	As needed	As needed	No sched	No sched	2400 hr	No sched
Time	10 min	15 min	Unk	10 min	Unk	Unk
Lubrication	4 wk	Weekly	Weekly	3 wk	200 hr	Weekly
Time	30 min	15 min	10 min	30 min	Unk	10 min
Preventative Maintenance Time:						
Man-hours expended for daily servicing (Av)	None	None	5-10 min	None	5 min	5-10 min
Man-hours expended for weekly preventative maintenance servicing (Av)	None	1 hr	30-40 min	None	None	30-40 min
Man-hours expended for monthly preventative maintenance servicing (Av)	1 hr	35 min	N/A	2 hr	2 hr	N/A

18. Component Replacement Data

Indicate the average time (min) required for one man to remove and replace:

Alternator	30	30	15	45	Unk	15
Starter	45	45	20	45	Unk	20
Voltage Regulator	30	30	10	10	Unk	10
Battery	5	5	10	10	Unk	10
Fan Belt	30	30	20	10	Unk	20
Hydraulic Pump	90	90	90	120	Unk	90
Brake Shoes	60	60	120	240	Unk	120

19. Safety and Human Factors (User Comments)

Do you augment the manufacturer's safety precautions?	No	No	Yes	No	No	Yes
Do you know of any safety hazards that exist during:						
Operation	No	No	Visibility	No	No	Visibility
Maintenance	No	No	No	No	No	No
Are the following safety and human-factors items/elements furnished as standard or optional equipment adequate?						
Gauges and monitors	Yes	Yes	Yes	Yes	Yes	Yes
Controls within easy reach and clearly marked?	Yes	Yes	Yes	Yes	Yes	Yes
Anti-skid walkway surface	Yes	Yes	Yes	Yes	Yes	Yes
Does operator's size inhibit his performance?	No	No	No	No	No	No
Do any safety hazards exist?	No	No	No	No	No	No
Does the sound level cause operator fatigue after prolonged operation?	No	No	No	No	No	No
Is special training required for:						
Operators	No	Yes	No	No	No	No
Maintenance Personnel	Yes. Hydro-static Trans-mission School	No	No	No	No	No

20. Manuscripts, Manuals, Tools, and Test Equipment (User Comments)

Were operator, maintenance, and parts manuals furnished with the item of equipment	No; requested for each truck	Yes	Yes	Yes	Yes	Yes
Are technical bulletins provided periodically by:						
Dealer?	No	Yes	Yes	No	Yes	Unk
Manufacturer?	No	Yes	Yes	No	No	Yes
Do you use the commercial manual as supplied by the manufacturer/dealer?	Yes	Yes	Yes	Yes	Yes	Yes
Have any difficulties been encountered using the manuals as reference in the following areas:						
Operating/setup instructions?	No	No	No	No	No	No
Servicing instruction?	No	No	No	No	No	No
Adjustments?	No	No	No	No	No	No
Repair and maintenance?	No	No	No	No	No	No
Are special tools required by operators or mechanics to maintain or test/ troubleshoot any portions of the equipment?	No	No	No	No	No	No
Are special tools provided by the manufacturer?	N/A	N/A	N/A	N/A	N/A	N/A
Are special tools described in the manual?	Yes	N/A	N/A	N/A	N/A	N/A
Is the use of special tools sufficiently described in the operator/repair manual?	Yes	N/A	N/A	N/A	N/A	N/A

21. Training and Logistic Support

Are dealer repairs performed promptly?	Yes	Yes	Yes	No	Yes	Yes
Any difficulty in training operator and/or maintenance personnel?	No	No	No	No	No	No
Is timely technical assistance available when required:						
From Dealer?	Yes	Yes	Yes	No	Yes	Yes
From Manufacturer?	Yes	Yes	Yes	Yes	Yes	Yes
Would you purchase like additional and/or replacement items?	Yes	Yes	Yes	Yes	Yes	Yes
Do you attempt to standardize names and/or models of equipment/ components within your fleet?	Yes	Yes	Yes	Yes	Yes	Yes

What is the length of warranty in equipment hours/months?	6 mo or 1000 hr	6 mo or 1000 hr	1 yr	90 days	1 yr	1 yr
What is the total number of warranty claims?	Very few	2 for 10 trucks	Unk	Unk	None	Unk
Are delays frequently caused by the lack of timely receipt of repair parts?	No	No	No	Unk	No	No
What repair parts do you keep on hand for this item? If none stocked, why not?	Almost every-thing	None; parts readily available	Most parts	Most parts	None	Most parts
What is the length of time to fill emergency orders when parts are not in dealers stock?	8-16 hr	4-8 hr	2-3 days	1-21 days	24 hr	2-3 days
What is the length of time to fill normal orders when parts are not in dealers stock?	1 wk	8-24 hr	2-3 days	1-21 days	48 hr	2-3 days

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